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Title of Invention	The coating for the electronic device member with a superior heat dissipation.



## Abstract

While the required original property (the confidentiality secure accompanied with the waterproofing · dustproof lighting fitting, and the miniaturization · light weight) is satisfied with the electronic device member, the coating for the new electronic device member which the base saponization (protection against heat characteristic) of this electronic device member inner temperature can include is offered.

T coating using the heat dissipation automated test equipment shown for fig. 1, and the exoergicity film having the heat dissipation in inside and outside side of substrate is coated when using coating as the advertise ash. Film is coated.

1The temperature T of location.1AT when using the substrate in which film is not coated as the advertise ash.

1The temperature T of location.1BOf.Difference  $\Delta T.1 (= T1B - T1A$  The coating for the electronic device member with a superior 2.6°C or greater heat dissipation.

Moreover, the coating for the electronic device member in which for the exoergicity film having the heat dissipation in inside and outside side of substrate, the heat dissipation satisfying  $A \times b \geq 0.42$  the integral

emissivity of the infrared ray (wavelength  $4.5\sim 15.4\mu\text{m}$ ) when heating coating with  $100^{\circ}\text{C}$  film was coated as the advertise ash says to be the infrared ray integral emissivity of coating b coating uses the heat dissipation automated test equipment shown for fig. 1 coated the exoergicity film is coated the infrared ray integral emissivity of coating in a, and the rear side the exoergicity film is coated in the surface excellents.



### Representative Drawing(s)

Fig. 3



### Description

#### ■ Brief Explanation of the Drawing(s)

Fig. 1 is  $\Delta$  in the invention coating.T1(Heat dissipation) And  $\Delta$ T2(The magnetic cooling nature) The schematic diagram of the apparatus which it uses in order to evaluate.

Figure 2 is a graph showing the range of the protection against heat characteristic ( $a \times b$ ) in the first coating related to the invention.

Figure 3 is a graph showing range with a superior magnetic cooling nature and protection against heat characteristic both parties in the second coating, related to the invention.

Fig. 4 is  $\Delta$ .T1The graph showing the relation of ( $a \times b$ ) of the infrared ray radiation rate of the surface · rear side.

Figure 5 is a graph showing the relation of ( $a \times b$ ) of the infrared ray radiation rate of P value [ $=(X - 3) \times (Y - 0.5)$ ] and surface · rear side.

Fig. 6 is  $\Delta$  in the working example 5.T2The graph showing relation with Q value ( $= 0.9a - b$ ).

Fig. 7 is  $\Delta$  in the working example 5.T1The graph showing relation with R value [ $=(a - 0.05) \times (b - 0.05)$ ].

Figure 8 is a schematic diagram of the protection against heat characteristic automated test equipment partly coated to the shielding member.

Figure 9 is a schematic diagram of the protection against heat characteristic automated test equipment coating the front to the shielding member.

Figure 10 is an outline diagram showing the desirable location of the temperature measuring apparatus used to the invention apparatus.

Figure 11 is a graph showing the relation of the content (X) of the carbon black and coating film thickness (Y) in the working example 1.

Figure 12 is a graph showing relation with the wavelength of the infrared ray and emissivity in the No. 1, of the working example 2.

Figure 13 is a graph showing relation with the wavelength of the infrared ray and emissivity in the No. 2, of the working example 2.

Figure 14 is a graph showing relation with the wavelength of the infrared ray and emissivity in the No. 3, of the working example 2.

Figure 15 is a graph showing relation with the wavelength of the infrared ray and emissivity in the No. 4, of the working example 2.

The description of reference numerals.

1 advertise ash (subject) 2 insulating material 3 heating element 4 shielding member (cover) 5 temperature measuring apparatus.

## ※ Details of the Invention

### ※ Purpose of the Invention

#### ※ The Technical Field to which the Invention belongs and the Prior Art in that Field

The invention relates to the coating for the electronic device member with a superior heat dissipation as to the frame body including the electronics, the electricity, the optical instrument (the case of representing to the electronic device hereinafter has) etc. The invention relates to the subject the coating for the electronic device member coating the coating composition which Yus YongHa to form coating : for the electronic device member with a superior among them, especially, : heat dissipation and magnetic cooling nature the electronic machinery part : heat dissipation with a superior property of coating : thises which moreover, the conductivity excellent for the electronic device member and coating with a superior conductivity, and is coated. And when, it is about the heat dissipation automated test equipment for evaluating the heat dissipation of the subject. According to the coating film thickness the black additive including the coating of the present invention is the carbon black etc, correlation is had and it appropriately contain. Therefore the protection against heat characteristic very excellents. It proper in the information write field : personal computer of the CD, LD, DVD, CD-ROM, CD-RAM, PDP, LCD etc, the car navigator, the car AV, including, the electrical & electronics · communications related field etc. And it can use as the copy machine : air conditioner outsider, including, the power box cover, control box cover, vending machine, the frame body for all kinds of the electronic device members including refrigerator etc including the AV machine : copy machine of the projector, television, video, the game console etc, printer etc. Moreover, the coating of the present invention can use as the chromium-free (Cr free) coating. Harmful 6 \*\*\* contain does not the chrome the corrosion resistance and the coating adhesiveness equal to the chromate treated steel are had moreover. And it very usefals in the point which the good workability can offer the chromium-free coating it moreover includes.

Prior art.

According to the high performance conversion · miniaturization including recent, the electronics · electricity · optical instrument etc, for the calorific value, problem including the enlargement (hot-spot), etc. generates in the chassis inside including the electronic device etc. becomes high temperature (the high heating of the electronic device inside). As to the inner temperature of the electronic device, about 40~70℃, and the task which is hot temperature of about maximum 100℃ generally has to the ambient temperature. However, if it \*\*\*, the heat-proof high temperature of the IC, the CPU (the semiconductor device), disc, the motor etc is over. Therefore the bring about impediment in the stable operation task is pointed out. Besides, the problem

that the lifetime of the electronic machinery part falls is undertaken temperature rises, the semiconductor device being broken and being out of order, etc.

And as the heat-resisting means for making the inner temperature of the electronic device the decline (heatproofing), the method for establishing the heat dissipation device including the heat sink or the heat pipe etc. in the pack panel (the pack panel etc) of the frame body (frame body main body, frame, the shielding case (shield case), the liquid crystal etc of the electronic device is proposed. But the heat emitted from the heating source (the heating element) of the electronic device inside cannot be obtained at most from this method in the frame body about the effect of the extent of diffusing. In case the volume of the frame body particularly smalls, the thermal performance as much as frame cannot be obtained. Moreover, the time hangs on the installation of this heat dissipation device. The installation place has no choice but to be the separate secure. It the Lee discomfort which the cost high comes in, etc. Therefore it is improper to apply to the electronic device use pointing to the miniaturization · low-price conversion.

Moreover, the metal plate (coating) is used for the frame body of the electronic device. Hole is drilled in this metal plate and the fan is established. The method for releasing heat by using the convection is proposed. But generally, the electronic device weaks at the water or the dust. Therefore problem has according to use like the case including the heat sink etc. in the point including the cost increase of the part, the effort of installation and secure of the installation place etc. States before in extrinsic that application difficults.

And while the required original property (the confidentiality secure accompanied with the waterproofing · dustproof lighting fitting, and the miniaturization · light weight) is satisfied with the electronic device, the offer of the frame body for the new electronic device member which the decline (protection against heat characteristic) of this electronic device inner temperature can accomplish is wished.

In the meantime, in the frame of the electronic device, it is required to control the temperature rise of two days itself besides the above-described protection against heat characteristic. Accordingly, the danger of the etc. which is touched with two days and in which consumer wears in the operating of the goods of electronic machine can be prevented. The safe product be offered. In order that distinguish between 「the heat dissipation」 stating before this 「the property of controlling the temperature rise of the frame itself of the electronic device」, it calls on the invention because of the especially 「the magnetic cooling nature」. The frame in which these positive temperature coefficients excellents is obtained. The similar problem is also proposed due to the thing adopting above-described radiant heat measure (the method, for establishing the heat dissipation device including the heat sink or the heat pipe etc. or method etc. in which hole is drilled in the metal plate and establishing fan). Therefore, the offer equipped with these positive temperature coefficients of frame is wished.

Moreover, in the frame of the electronic device, it is required to the property of mentioning above and besides conductivity excellent. But in the black painting steel sheet (the steel sheet in which the black film is coated) etc., the problem that the earth well \*\*\*s as frame have is previously used to apply to the electronic device since the film thickness of the black film so thick and the electric resistance value is enhanced.

And in convention, the chromate treatment is in the point of view including the corrosion resistance, the coating adhesiveness etc. in substrate if it has an eye on of the substrate side. However, the problem of the environmental contamination seriously comes to the front in that harmful 6 the chrome the usage in large amount. Correspondence to the field chromate treatment (non-chromate) of chromium-free is and requested instead of the harmful chromate treatment. But in case of not the chromate treatment it is moreover known as the corrosion resistance or the coating adhesiveness that workability is behind. Therefore, moreover the corrosion resistance, and the coating adhesiveness the coating of the chromium-free which workability excellents in spite of doing not do the chromate treatment. The above-described heat dissipation, and the offer of the frame body for the electronic device member which the magnetic cooling nature excellents are wished.

The present invention is to provide the heat dissipation automated test equipment it has an eye on of the circumstances and it is included, and the purpose coating, and used as the frame of the electronic device for evaluating the heat dissipation of the subject and coating composition : with a superior heat dissipation, the conductivity, the corrosion resistance, the coating adhesiveness and workability the coating composition applied to the coating composition : chromium-free system summer solstice processing which forms to one substrate. Required from the electronic device member.

#### ■ Structure & Operation of the invention

The coating (it is hereinafter called as the first coating) with a superior heat dissipation on the invention solving the subject coating the exoergicity film having in other words, the heat dissipation in the front backside surface of substrate inside and outside of substrate is coated. For this kind of heat dissipation, the black additive is composed in the base resin consisting of the concrete composition, for obtaining coating excellent is the poly ester resin, polyolefin resin, fluorine-based resin, silicone resin in inside and outside side of substrate and their mixing or the degenerated resin. The cross-linking agent, the conductive pillar, the rust preventive etc. are added according to moreover, need and the coating for the electronic device member coated to the exoergicity film is composed. The following equation one side at least contain the black additive this exoergicity valuableness. Gist is had to satisfy (1).  $(X - 3) \times (Y - 0.5) \geq 15 \dots\dots\dots (1)$  In the formula, the content (mass %) of the black additive which X is contained in the exoergicity film Y respectively implies the coating film thickness ( $\mu\text{m}$ ). Here, X (the content of the black additive contained in the exoergicity film) is  $4 \leq X \leq 15$  [type(3)] In order to obtain the heat dissipation which satisfies, : Y (coating film thickness) satisfies  $Y \leq 1 \mu\text{m}$ , the average particle diameter of the black additive satisfies 5~100nm, excellents than the thing in which : black additive is the carbon black, it usefult. The invention relates to the index showing 「the excellent heat dissipation」. And gist is had upon the point satisfying the property of below (I) or (II).

( I ) T using the heat dissipation automated test equipment shown for fig. 1 described later, and when using coating as the advertise ash. 1AT when using the substrate in which film is not coated as the advertise ash. 1The temperature T of location. 1B The difference  $\Delta$  of NULL.  $T_1 (= T_{1B} - T_{1A})$  The 2.6°C or greater thing.

( II ) Moreover, when heating coating with 100°C The  $b \geq 0.65$  and/or  $a \geq 0.65$  and the thing in which the difference (A-B) with the maximum value A of the spectral emissivity and minimum value B are 0.35 or less as to the wavelength region of 4.5~15.4 $\mu\text{m}$  the moreover encouraged mode (2) is satisfied.

$$a \times b \geq 0.42 \dots\dots\dots (2)$$

a: the infrared ray integral emissivity of coating the exoergicity film is coated in the surface.

b: the infrared ray integral emissivity of coating the exoergicity film is coated in the rear side.

Moreover, coating the deletion the exoergicity film having and, substrate, at least, the heat dissipation in the surface it is called is coated in the invention solving the subject less than the coating ( with a superior 「 heat dissipation and the magnetic cooling nature related to to the second coating

「The excellent magnetic cooling nature」 Below (III) or (IV) the index showing:

As the index showing the coating 「the good protection against heat characteristic」 of this second, gist is had to satisfy below (V).

(III) The coating temperature T using the heat dissipation automated test equipment for showing for fig. 1, and when measuring coating as the advertise ash.2A The substrate temperature T when using the substrate in which film is not coated as the advertise ash.2B The difference  $\Delta$  of NULL. T2 (= T2B - T2A) The 0.5°C or greater thing.

(IV) When heating coating with 100°C. (4) is satisfied.

$$b \leq 0.9(a - 0.05) \dots\dots\dots(4)$$

(V) When heating coating with 100°C. (5) is satisfied.

$$(a - 0.05) \times (b - 0.05) \geq 0.08 \dots\dots\dots(5)$$

a: the infrared ray integral emissivity of coating the exoergicity film is coated in the surface.

b: the infrared ray integral emissivity of coating the exoergicity film is coated in the rear side.

The following equation this exoergicity film contain the black additive to coating the exoergicity film having and, substrate, at least, the heat dissipation in the surface in the concrete composition for obtaining, film is coated in inside and outside side of substrate is coated the coating with a superior this 「the heat dissipation and magnetic cooling nature」.

Gist is had to satisfy (6).

$$(X - 3) \times (Y - 0.5) \geq 3 \dots\dots\dots(6)$$

In the formula, the content (mass %) of the black additive which X is contained in the exoergicity film

Y respectively implies the coating film thickness ( $\mu\text{m}$ ).

Here, X (the content of the black additive contained in the exoergicity film) is  $4 \leq X \leq 15$  [type(7)] In order to obtain the property it satisfies, : Y (coating film thickness) satisfies  $Y \leq 1\mu\text{m}$ , the average particle diameter of the black additive satisfies 5~100nm, of excellenting than the thing in which : black additive is the carbon black, it usefult.

Moreover, the electric resistance besides satisfies 100 $\Omega$  or less, gist is had in addition to the property the case of filling in the invention solving the subject less than the coating ( with a superior 「heat dissipation (in other words, the magnetic cooling nature) and the conductivity related to as the third coating has, of stating before. The conductive pillar (filler) (preferably, Ni) is contain specifically in the exoergicity valuableness.

As to the above-described coating body (the coating body of the first ~ third) of the present invention, if the hydrophobic resin (preferably, the poly ester resin) is used as the resin forming exoergicity film, since the corrosion resistance is improved, the desirable mode.

Moreover, as to the invention, my crack nature and anti-finger printing can be enhanced that the clear film is coated in the exoergicity film. Therefore, it usefult.

The coating of the present invention can apply to the chromium-free (Cr-free) coating. That is, moreover, the exoergicity film is the rust preventive (防 the summer solstice processing of chromium-free becomes



substrate (精) It is preferable that 劑) is contain. Specifically, in the formation component of the exoergicity film, the poly ester resin introducing the epoxy degeneration poly ester resin and/or the phenol derivative to skeleton and the to contain cross-linking agent (preferably, the isocyanate system resin and/or the melamine resin, and the thing which more preferably uses jointly both). Thing is encouraged the accordingly excellent corrosion resistance [less than the area rate : 10% of the outer tube phase shift unit in the salt spray test corrosion test (72 hours) ruled in JIS-Z-2371], the coating adhesiveness (the exfoliation situation of film the bent portion is tempered), and the workability (less than the number of crack : 5 in the intimate bending test ruled in the JIS K 5400) can be secured. Moreover, if it to 2 layer film configuration in which film is coated on film, since obtaining the more and more excellent corrosion resistance [less than the area rate : 10% of the outer tube phase shift unit in the salt spray test corrosion test (120 hours) ruled in JIS-Z-2371] since preventing the elution of the rust preventive, it very usefult. Here, if the film coated on film is to the clear coating film, moreover, my crack and anti-finger printing can enhance.

And if the conductive pillar (preferably, Ni) is added in film, the excellent conductivity (less than the electric resistance 100Ω) can be secured. Moreover, if the conductive pillar is added among film, the corrosion resistance falls but by at least controlling the coating film thickness of the surface over 2μm the good corrosion resistance can be kept among the film coated in inside and outside side.

And the coating composition for the electronic device member of the present invention solving the subject has gist to contain 3 mass % excess and conductive filler about the forming component of coating film 10~50 mass %. The film with a superior heat dissipation and conductivity it uses can be formed. Here, the average granularity of the black additive the desirable mode that it is Ni that it is the carbon black to 5~100nm.

Moreover, in the invention, the coating composition applied to the substrate in which the chromium-free system primer treatment is performed. The coating composition for the electronic device member which contain 3 weight part excess and conductive pillar 10~50 mass unit is included 1~20 mass unit, and the black additive over 35 mass unit in range of the present invention. Introduces the epoxy degeneration poly ester resin and/or the phenol derivative to skeleton.

Here, it is preferable that the cross-linking agent the melamine resin is about the isocyanate system resin 100 mass unit to the rate of 5~80 mass unit, it. Moreover, the average particle diameter of the black additive 5~100 nm. And the use of the carbon black is encouraged. And in the conductive pillar, the use of Ni desirables. The chromium-free system film with a superior heat dissipation, the conductivity, the corrosion resistance, the coating adhesiveness and workability the coating composition satisfied is used can be formed.

Besides, in the invention, in the electronic machinery part (for example, the AV machine : copy machine of the electrical & electronics · communications related field : projector, television, video, the game console etc, printer, including, the copy machine : air conditioner outsider, including, the power box cover, control box cover, vending machine, refrigerator etc including the information write field : personal computer of the CD, LD, DVD, CD-ROM, CD-RAM, PDP, LCD etc, the car navigator, the car AV etc) consisting of the above-described coating for the electronic device member of the present invention, a part is all in other words included to the electronic machinery part having within the heat sink in the closed space of the exterior wall in range of the present invention.

And in the invention, the heat dissipation automated test equipment evaluating the heat dissipation of under test board. A part is all in other words composed of the ceiling surface of the equipment under test. In the side and bottom surface, the heating element are installed in the bottom surface of the upper body. And consisting of the insulating material the heat dissipation automated test equipment establishing the temperature measuring apparatus, in other words, the temperature measuring apparatus is included within moreover, the upper body in approximately, the central part in range of the present invention. Here, the heat dissipation automated test equipment establishing the shielding member which secludes from the outside condition in the upward of the subject can block up the factor (outside or resonator, including, the wind etc) in which the concern going mad

the bad effect on the heat dissipation has. The protection against heat characteristic can be evaluated to be stable. Therefore, it very usefuls.

The preferred embodiment of the present invention.

The coating for the electronic device member of the present invention is equipped with the form of below (a) ~ (all).

(a)The coating for the electronic device member with a superior heat dissipation(first coating)

(b) The coating of the electronic device member the coating (second with a superior heat dissipation and magnetic cooling nature.

The).

(c) As to the coating of (b) and (a), the conductivity moreover improves.

Coating (the the third coating)

Firstly, it explains for the fundamental thought commoning to (a) ~ (all).

While these inventors satisfied the required original the property (the confidentiality secure, accompanied with the waterproofing · dustproof lighting fitting the miniaturization · light weight, the low cost etc) with the electronic device, in order to the decline (protection against heat characteristic) of this electronic device inner temperature offer the coating for the new electronic device member could accomplish, it had been examining in earnest around especially, the heat dissipation improvement of this coating itself. Consequently, it found that the object of the one's expectation it coats was attained the predetermined film in inside and outside side of substrate.

The mechanism 「the absorption (radiation), and 2 line are diffused in the film of the rear side from the exoergicity film of the surface emitted from the heating source (heating element) of the electronic device inside」 increase. The feature of maximum to well apply the design of the so called 「heat penetration mode」 to the electronic device member. The design of this 「heat penetration mode」 is applied to the electronic device member. Coating the new which it does not inform convention. Diffuses the calorie 「the surface of substrate」 emitted from the electronic device to → 「the surface of substrate」 the absorption →.

Next, before it explains for the square stamp. It explains for the relation of the first coating (the coating with a superior heat dissipation), and the second coating (coating with a superior heat dissipation and magnetic cooling nature).

The fundamental thought accords in that the design of 「heat penetration mode」 which as to the first coating, the second coating altogether mentions above is applied to the electronic device member and the improvement of the heat dissipation is plotted, it is different, as to both sides, the task to solve (the task to solve which is the head of) that it ultimately points to, and the technical spirit and the configuration for solving this task to solve but comes in the improvement (the decline of the electronic device inner temperature) of the heat dissipation in other words, the first coating about the task to solve of maximum. While to some extent keeping the protection against heat characteristic by using 「the design of the heat penetration mode」 which into one body into one bodies and grasps and which constitutes the exoergicity film under the thought called 「desirables what high as long as of the infrared ray radiation rate of the surface · rear side possibles」 and it specifies, mentions above the configuration of this exoergicity film in the coating of : second, the moreover 「the control of temperature rise of the coating itself」 is in come about the task to solve of maximum. As to both sides, the directionality pointed to says to be the other invention lice in the point 「car is left actively about the infrared ray radiation rate of inside and outside side. The infrared ray radiation rate of the rear side lows than the surface. By highing as



long as the infrared ray radiation rate of the surface possible the heat absorbed into coating is released」 and in which the film configuration of the surface · rear side is for the sake of done respectively separately under the thought and controlled.

That is, in the first coating, the thing in which the heat dissipation quite goods, and the form in which the magnetic cooling nature falls include. In the meantime, in the second coating, the magnetic cooling nature very excellent. However, if it compares to the first coating, the a little bit low form includes about the heat dissipation. The domain [the equation deciding the domain [the range that the protection against heat characteristic satisfying the equation (1) excellent] that it in order to certain the difference of this kind of both sides decides in the first coating in fig. 2 in the coating of : second. Range and the equation in which the protection against heat characteristic satisfying (5) excellent. The overlap portion] with the range that the magnetic cooling nature satisfying (4) excellent is shown respectively for fig. 3. The area which very excellent both teeth is the protection against heat characteristic as to these coating, s part [the protection against heat characteristic excellent because the enemy of the infrared ray radiation rate of inside and outside side high. The magnetic cooling nature excellent because the surface infrared ray radiation rate high in comparison with and, the rear side] which each other put one upon another include and magnetic cooling.

Hereinafter, it explains for coating related to the invention.

(a) About the coating (first coating) for the electronic device member with a superior heat dissipation.

It lights to accomplish and completes the object of the one's expectation the exoergicity film is coated of predetermined having the heat dissipation in inside and outside side of substrate the above-described fundamental thought to the base.

That is, the technical mapping is had to secure the excellent heat dissipation by using coating, coats the exoergicity film satisfying integral emissivity (it reduces by the simply 「the infrared ray integral emissivity」 or 「the infrared ray radiation rate」 and it hereinafter calls) in the arbitrary infrared wavelength reverse (the wavelength : 4.5~15.4 $\mu$ m) in the surface of substrate and rear side [in the invention, it looks at in this coating and the open air side 「surface」 is called as the inner side 「rear side」 of this coating] is the fixed range the first coating the coating for the electronic device member.

It earlier. The conventional coating. The trouble footer coat material (after coat 材) coated with paint, and the precoating agents (pre coat 材) which it in advance coats with paint in raw can be in come after for example, processing including the press processing etc. However, as to these, the exoergicity film which has the predetermined heat dissipation like the invention 「it applies as the frame body for the electronic device member. The design of the heat penetration mode is applied and the heat dissipation is enhanced」 upon inside and outside side of substrate because of the thought at all having no is not coated. As to the real, and their conventional coating, the outer capillary surface are coating processed in the point of view including the graphical design function or the functionality (the corrosion resistance etc) etc. However, the protection against heat characteristic lows. In the meantime, in the rear side (coating inner surface), the dance hall or not to about the coating of the extent (the protection against heat characteristic of frame therefore cannot obtain) of at most securing the corrosion resistance of the Choe JeoHan even if it was painted, tell thing the real image. And in this kind of one side coating, it is identified with the working example which later explains to cannot obtain the protection against heat characteristic as much as frame.

Hereinafter, it specifically explains for coating.

It shows for below (I) the exoergicity film having the first coating is the heat dissipation in inside and outside side of substrate is coated, and the index showing 「the excellent heat dissipation」 .(of the infrared ray radiation rate of the surface of coating and rear side) show 「a x b」 ed is satisfied with T 1 (the difference of the inner temperature of the electronic device) or below (II).

The double, and 「a × b」 decide the enemy of the emissivity of the infrared ray emitted from coating. It usefals as the index showing the thermal performance of coating. In the meantime,  $\Delta T_1$  decides the thermal performance of the conference one practical level. The protection against heat characteristic can be evaluated as the accessibility as to the present ambient temperature (broad, 50~70°C, about supremely, 100°C the ambient temperature dissimilars according to the kind of the electronic device etc). Therefore, the reason for adopting as to the invention.

In this way, both sides Yus YongHa as the index showing the everyone 「heat dissipation」. It has with the moreover good correlation. For your reference, the plot one graph was shown for fig. 4. Among the drawing, the composition of the exoergicity film of inside and outside side increasing respectively show the result of coating the composition of the exoergicity film of inside and outside side the same (use the carbon black as the black

additive).



According to the first coating satisfies this kind of protection against heat characteristic, the calorific value at the chassis inside according to the high performance conversion · miniaturization of the electronic device the increase (hot-spot) and it becomes high temperature. Still, the temperature of the electronic device inside can be dropt because the protection against heat characteristic excellents. Therefore, the new enlargement (the high speed, the high performance conversion, miniaturization etc) of the lifetime prolongation of life, the power save, the low noise, the apparatus design degree of freedom of the electronic machinery part can be plotted. It very usefals.

Hereinafter, it explains for each property.

$$(I) \Delta T_1 (= T_{1B} - T_{1A}) \geq 2.6^\circ\text{C}$$

Here,  $T_{1A}$  using the heat dissipation automated test equipment shown for the attached view drawing 1, and when using coating as the advertise ash.1:  $T_{1B}$  similarly using the heat dissipation automated test equipment of fig. 1, and when using the substrate in which film is not coated as the advertise ash.1The temperature of location is implied respectively.

$\Delta T_1$  in the invention 1 compares in case of using the substrate (A, originally, the disk in which film is not coated).TThe heat dissipation automated test equipment which was unique the invention shown as the apparatus for measuring 1 for especially, fig. 1 was used. The apparatus of fig. 1 very usefuled to use including the electronic device etc. as the apparatus for evaluating the protection against heat characteristic of the present ambient temperature (broad, 50~70°C, about supremely, 100°C the ambient temperature dissimilars with the kind of the electronic device member etc). And the thermal performance at the practical level which accordingly held a conference the electronic device use was evaluated correctly. The heat dissipation automated test equipment for including the convention, and in this way, the apparatus of fig. 1 the useful apparatus for evaluating the heat dissipation had no is included in range of the present invention (it is described later).

Figure 1 is an apparatus of the cuboid in which the internal space is 100 mm (length) × 130 mm (width) × 100 mm (height). Among fig. 1, as to as to as to the denotation (1), advertise ash (the subject, and the square measure is 100 × 130mm), and the denotation (2), the insulating material, and the denotation (3), heating element [the most long length (the length of the diagonal in the drawing 1) which the low area can \*\*\* in 1300mm<sup>2</sup>, and this heating element area of the straight line is 164mm<sup>2</sup>], and the denotation (5) the temperature measuring apparatus.

In the double, and the heating element (3), the silicone rubber heater is used. It uses to adhere closely the aluminium plate (less than the infrared ray radiation rate is 0.1) to the upper part. Moreover, T of fig. 11Thermocouple is fixed on the location [the central part (50mm upward in the heating element (3)) of the internal space] as the temperature measuring apparatus (5). Moreover, the lower part of thermocouple is up covered to the purpose of excluding the influence of the thermal radiation from the heating element.

And T by the method which the infrared ray radiation rate therefore uses the metal plate [for example, the electrolytic galvanized iron (the JIS SECC etc)] of 0.03~0.06 that in the insulating material (2), the ambient temperature changes according to the kind or the use condition etc. within the box (influence is given to the heat dissipation), and says later 1 The installation method of the insulating material etc. is adjusted so that the ambient temperature (absolute value temperature) of location be ranged of about 73~74°C. Besides that, the factor (for example, the fixation of the advertise ash etc), going mad influence on the heat dissipation similarly, T1 It adjusts so that the ambient temperature (absolute value temperature) of location be ranged of about 73~74°C.

Next, it explains for the method for evaluating the protection against heat characteristic by using the apparatus.

Temperature the purpose of removing error on data by the open air condition (the wind etc) as to measurement the measurement condition: 23°C, and the relative humidity: it controls to 60%.

Firstly, each advertise ash (1) is established. The power source is put and the hot plate 3 is heated to 140°C. T the temperature of the hot plate calms down. 1 After it confirms that the temperature of location becomes over 60°C, the advertise ash is removed first of all. In the point of time when temperature goes down within the box to 50°C, the advertise ash is established again. Temperature is measured respectively within the box after 90 minutes after establishing. And the difference ( $\Delta$  when using the dance hall disk that did not do the temperature, when using the advertise ash and coating of temperature T1 It produces.

Moreover,  $\Delta$  T The middle high limit, and  $\Delta$  in the invention the mean of data of three-point except for the limit inferior 1 measures according to each advertise ash 5 time. T1 It decided as.

In this way, it calculates  $\Delta$  T1 means that the protection against heat characteristic excellents as much as it bigs. The desirable order over 2.7°C over 3.0°C over 3.3°C over 3.5°C over 3.7°C 4.0°C or greater.

And the index (target level) of the protection against heat characteristic dissimilars according to the kind of the electronic device etc. However, as it says later according to the invention. By appropriately controlling the black additive included in the exoergicity valuableness to relation with the coating film thickness it facilitates, the predetermined protection against heat characteristic can be adjusted.

(II) Equation (1) :  $a \times b \geq 0.42$ .

In the formula, a and b respectively imply the infrared ray integral emissivity (a) of the surface and infrared ray integral emissivity (b) of the rear side as to the integral emissivity of the infrared ray (wavelength : 4.5~15.4 $\mu$ m) when heating coating with 100°C the exoergicity film was coated in inside and outside side of substrate. The infrared ray integral emissivity measures at the method which will be described later. The infrared ray integral emissivity of the surface or the rear side can be measured respectively separately.

「infrared ray integral emissivity」 puts in other words. It eases to emit of the infrared ray (heat energy), (it eases to absorb) is implied. Therefore, as the infrared ray radiation rate highs, the thermal energy amount which is the emission (absorption) shows to grow larger. For example, in case of radiating the heat energy given in the object (the coating in the invention) 100%, this infrared ray integral emissivity is 1 this.

Moreover, in the invention, the infrared ray integral emissivity when heating is decided as 100°C. However, this considers that the invention coating is applied to electrical machinery and apparatus use (the normal ambient temperature, broad, 50~70°C, supremely, about 100°C it differs according to absence etc). In order that it tallies with the temperature of this practical level, the heating temperature is decided as 100°C. However, the infrared ray integral emissivity nearly does not change even if it heats with 200°C. The infrared ray integral emissivity when heating with 200°C confirms with experiment to approximately, 0.02 gad high in comparison with the infrared ray integral emissivity of 100°C but nearly accord (and, in the working example saying later, the infrared ray radiation rate when heating with 100°C and 200°C is juxtaposed respectively).

The method of measurement of the infrared ray integral emissivity as to the invention is same as those of hereinafter.

Apparatus: the Japanese electronics (main part) the 「JIR-05500 Fourier transform infrared spectrophotometer」 and radiation.

Gad unit 「IRR-200」.

Measure wavelength range: 4.5~15.4 $\mu$ m.

Measured temperature: the heating temperature of sample is established as 100°C.

Product return: 200 time.

Resolution: 16cm.<sup>-1</sup>

The apparatus was used. The spectral radiant intensity (actually measured value) of the sample in the infrared wavelength reverse (4.5~15.4 $\mu$ m) was measured. Moreover, by using the emissivity measuring program [japanese electronics (main part) the emissivity measuring program] as the purpose of revising these because of measuring the radiant intensity and apparatus irrigation of the back ground as the value added the addition /, the actually measured value of sample produced the integral emissivity. The method of calculation thes same like less than.

[Number 1]

$$\epsilon(\lambda) = \frac{\frac{M(\lambda, T)}{A(\lambda)} - K_{FB}(\lambda, T)}{K_B(\lambda, T) - K_{FB}(\lambda, T)}$$

$$E(T) = \frac{\int_{\lambda_1}^{\lambda_2} \epsilon(\lambda) \cdot K_B(\lambda, T) \cdot d\lambda}{\int_{\lambda_1}^{\lambda_2} K_B(\lambda, T) \cdot d\lambda}$$

In the formula,  $\epsilon(\lambda)$ :the spectral emissivity of the sample in the wavelength  $\lambda$ (%)

$E(T)$ :the integral emissivity of the sample in the temperature  $T$  (°C)(%)

$M(\lambda, T)$ : the wavelength  $\lambda$ , and the spectral radiant intensity (survey of the sample in the temperature  $T$  (°C). Value).

$A(\lambda)$ :apparatus irrigation(裝置關數)

$K_{FB}(\lambda)$ : the spectral radiant intensity of the fixing back ground (the back ground which does not change according to sample) as to the wavelength  $\lambda$ .

$K_{TB}(\lambda, T)$ : the wavelength  $\lambda$ , and the temperature  $T$ .  $T_B$ The spectrum emission of the trump black body in (°C).

Intensity.

$K_B(\lambda, T)$ : the wavelength  $\lambda$ , and the spectral radiant intensity (\*\*\*) of the black body in the temperature  $T$  (°C).

The calculation value) from the theory type of chuck.

$\lambda_1$ ,  $\lambda_2$ : the range of the wavelength integrated is implied respectively.

Here,  $a$  ( $\lambda$ : apparatus irrigation) and  $KFB(\lambda$ : the spectral radiant intensity of the fixing back ground) it calculates based on the spectral radiant intensity (the calculation value from the theory type of the blank) of the black body in the actually measured value of the spectral radiant intensity of the black body oven (80°C, 160°C) increasing of 2 and this temperature range with the following equation.

[Number 2]

$$\frac{60^{\circ}\text{C}) - M_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C})}{60^{\circ}\text{C}) - K_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C})} \cdot M_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C}) - K_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C}) \cdot M_{160^{\circ}\text{C}}(\lambda, 160^{\circ}\text{C}) \\ M_{160^{\circ}\text{C}}(\lambda, 160^{\circ}\text{C}) - M_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C})$$

In the formula,  $m_{160^{\circ}\text{C}}(\lambda, 160^{\circ}\text{C})$ : the spectrum emission of the black body oven of  $160^{\circ}\text{C}$  as to the wavelength  $\lambda$ .

Intensity (actually measured value)

$M_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C})$ : the spectrum emission of the black body oven of  $80^{\circ}\text{C}$  as to the wavelength  $\lambda$ .

Intensity (actually measured value)

$M_{160^{\circ}\text{C}}(\lambda, 160^{\circ}\text{C})$ : the spectrum emission of the black body oven of  $160^{\circ}\text{C}$  as to the wavelength  $\lambda$ .

Intensity (the calculation value from the theory type of the blank)

$M_{80^{\circ}\text{C}}(\lambda, 80^{\circ}\text{C})$ : the spectrum emission of the black body oven of  $80^{\circ}\text{C}$  as to the wavelength  $\lambda$ .

The intensity (the calculation value from the theory type of the blank) is implied respectively.

Moreover, K as to the calculation of the integral emissivity  $E(T=100^{\circ}\text{C})$  TB( $\lambda$ , TTB) The trump black body water-cooled is arranged to the around the thing considering is sample as to measurement. Using the installation of the trump black body, the back ground radiation changing with the change back ground radiation (sample is implied). The radiation from the around sample is reflected to the surface of specimen. Therefore the actually measured value of the spectral radiant intensity of sample low can control the spectral radiant intensity. It appears as the value in which this back ground radiation gives. K the trump black body described in the above uses the will black body of the emissivity 0.96. TB( $\lambda$ , TTB): the wavelength  $\lambda$ , and the temperature T. TB The spectral radiant intensity] of the trump black body in ( $^{\circ}\text{C}$ ) calculates like this.

$$KTB(\lambda, TTB) = 0.96 \times KB(\lambda, TTB)$$

In the formula,  $kB(\lambda, TTB)$  The wavelength  $\lambda$ , and the temperature T. TB The spectral radiant intensity of the black body is implied as to ( $^{\circ}\text{C}$ ).

(a  $\times$  b) of the infrared ray integral emissivity (b) of the infrared ray integral emissivity (a) of coating and coating is 0.42 or more [type the exoergicity film is coated in the rear side in the first coating, the exoergicity film is coated to the integral emissivity  $[E(T=100^{\circ}\text{C})]$  of the infrared ray ( $4.5\sim 15.4\mu\text{m}$ ) which it in this way measures in the surface related to the invention.(1)It satisfies. As described above, in the coating satisfying the equation the value (the enemy of the infrared ray integral emissivity emitted from coating) calculating to 「a  $\times$  b」 usefals as the index showing the thermal performance of the coating itself is the wavelength region, the in average high radiation property was displayed, it decided as to the first coating as the target level 「a  $\times$  b  $\geq 0.42$ 」 of the protection against heat characteristic. 「a  $\times$  b」 (The maximum 1) The more value big (it nears if it nears to 1)s, the excellent protection against heat characteristic is displayed. To the desirable order over 0.49 over 0.56 over 0.61 over 0.64 0.72 or greater.

Moreover, the relation of the infrared ray radiation rate of the infrared ray radiation rate of the surface and rear side the target level of the protection against heat characteristic mentioning above in the first coating is satisfied comprise the infrared ray radiation rate of the surface and rear side is both of the other form and form having the emissivity of the extent in which both sides the same it is not particularly limited. With respect to this, in the second coating related to the invention, both sides differs in the point [it states in claim of (b) described later] limiting only the coating with high infrared ray radiation rate of the rear side the surface the improvement of the magnetic cooling nature is in addition to the heat dissipation to the main purpose.



Specifically, equation(1) 「 $a \times b \geq 0.42$ 」 As to the han satisfying protection against heat characteristic, the surface / rear side can decide the arbitrary infrared ray radiation rate. However, the maximum value of the infrared ray radiation rate continues 1. Therefore, in order to at least satisfy :  $a \times b \geq 0.62$  over 0.56 in order to at least satisfy :  $a \times b \geq 0.56$  over 0.42 in order to satisfy the equation (1), the infrared ray radiation rate of one side need to be at least over 0.64.

Here, the mode in which the thing satisfying at least, the infrared ray radiation rate of one side is 0.65 or greater the infrared ray radiation rate of one side bigs desirables. The more desirable order over 0.7 over 0.75 0.8 or greater. The both sides desirables than coating more than 0.65.

It is preferable that the difference (A-B) with the maximum value A of the spectral emissivity in the arbitrary wavelength region of the infrared ray (wavelength  $4.5 \sim 15.4 \mu\text{m}$ ) and minimum value B in the first coating 0.35 or less. This 「A-B」 shows the infrared wavelength reverse 「the dynamic range of emissivity」. 「 $A-B \leq 0.35$ 」 shows to calm down as to anything of the infrared wavelength reverse and display the high radiation property. Therefore, in the thing satisfying requisite, the enlargement of use to the electronic device member dragon is for example expected application to use including the electronic device etc. Gas NeungHa, etc the wavelength of the emitted infrared ray loads the other part the different kinds. Specifically, as described above, the arbitrary emissivity measured is measured. The difference (A-B) with the maximum value (A) of the spectral emissivity and minimum value (B) are produced in this wavelength region by 「the dynamic range of emissivity」. The small recording stable the protection against heat characteristic can be obtained if the value of 「A-B」 smalls. More preferably very preferably less than 0.3 0.25 or less.

Subsequently, the first coating is explained for the concrete composition for obtaining.

Coating. However, the exoergicity film having coating is the heat dissipation in inside and outside side of substrate is coated the content X (「%」 implies 「mass %」 as long as it particularly does not comment less than mass % :) of the black additive at least included the exoergicity valuableness in one side is controlled appropriately to relation with the coating film thickness Y ( $\mu\text{m}$ ). In that way the protection against heat characteristic of \*\*\* expected can be obtained. Specifically, X and Y is the following equationThe following equation (2) is satisfied.(3), and Y preferably satisfy  $Y > 1 \mu\text{m}$ .

① equation (2):  $(X - 3) \times (Y - 0.5) \geq 15$ .

Hereinafter, occasionally, the calculation value of the left side  $[(X - 3) \times (Y - 0.5)]$  is represented to P value.

The following equation.The protection against heat characteristic [ $\Delta$  which (2) mentions above.T1In other words, the content X (%) of the black additive at least contained as the configuration condition for obtaining the index] appearing as ( $a \times b$ ) the exoergicity valuableness in one side and relation of the coating film thickness Y ( $\mu\text{m}$ ) are decided. The task which it appropriately controls is necessary the black additive including the carbon black etc. in relation with the coating film thickness so that 「protection against heat characteristic」 decided in the first coating be secured to the equation imply. And 「the content of the black pigment is not manied (in other words, the black pigment content per the unit thickness grows larger) in case film thins. However, the content of the black pigment at least good (in other words, the black pigment content per the unit thickness gets smaller)s if the coating film thickness thicks」 and the opinion of the present invention is as a formula expressed.

Here, P value  $[(X - 3) \times (Y - 0.5)]$  and protection against heat characteristic show the mostly good correlation. Figure 5 is a target level ( $a \times b \geq 0.42$  of the protection against heat characteristic which comes in the first coating the relation of the protection against heat characteristic ( $a \times b$ ) and P value is graphed based on result (the table 4 and table 5), and  $\Delta$  of the working example saying laterT1P value need to be over 15 in order to secure  $\geq 2.6^\circ\text{C}$ ). According to the invention, P value in which the index of the protection against heat characteristic copes with \*\*\* surface, and that is produced. The merit which can secure readily the protection against heat characteristic as much as frame only by respectively appropriately adjusting the range of Y and X in order to obtain this P value has.

Moreover, as P value bigs in order to obtain the more excellent protection against heat characteristic, it desirables. As the desirable order over 7 over 11 over 15 30 or greater.

However, the protection against heat characteristic is saturated even if P value is overly a lot., in addition waste the invention coating is used as the frame body of the electronic device and it is required, workability and conductivity etc. are economically encouraged the high limit of P value to the only in which amount including the black additive etc. increases it uses to the desirable west net to control to 240, 200, 150, 100.

② Equation.(3):  $4\% \leq X < 15\%$

Moreover, in the invention, the content X of the black additive sets forth beforehand 3% excess. It is encouraged to over 4%. The thing, setting forth beforehand the activating 「 $X > 3\%$ 」 is the equation.(X - 3) is due to be necessary what the gad (>0) the coefficient of the left side of transplant in order to satisfy (2).

Moreover, the limit inferior of X obtains the excellent protection against heat characteristic. Simultaneously, it is decided in order to secure the property (lacquerability, the outer tube etc) of the coating itself. The property as much as frame cannot be obtained from 3% or less. The desirable limit inferior 5%, 7%, 8%, 10%. In the meantime, in the high limit of X is relation with the protection against heat characteristic, it is not specially controlled. However, if it becomes over 15%, lacquerability grows worse and the coating stain happens and the visual defect generates. Therefore, the desirable high limit considering lacquerability etc. to order under 15% 13%, 11%.

③  $Y > 1\mu m$

Besides, in the invention,  $0.5\mu m$  excess is forth beforehand set about the coating film thickness Y of the exoergicity film.  $1\mu m$  excess is encouraged. The thing the activating 「 $Y > 0.5\mu m$ 」 to premise is the equation.It is due to be necessary that (Y - 0.5) is the gad (>0) the coefficient of the left side of transplant in order to satisfy (4).

The limit inferior of Y is decided in order to specially obtain the protection against heat characteristic. The thermal performance as much as frame cannot be obtained even if Y very much adds the black additive in  $0.5\mu m$  or less. The desirable limit inferior to the west net  $3\mu m$ ,  $5\mu m$ ,  $7\mu m$ ,  $10\mu m$ .

Moreover, in the high limit of Y is relation with the protection against heat characteristic, it is not limited specially. However, the invention coating intends the application of the electronic machinery part. The relation phase with the accessibility, and the improvement of workability are required, it is encouraged to specially control in the bending time in consideration of the crack or the exfoliation of film, including, the generating prevention etc. to  $50\mu m$  less than (less than the west net desirabling is  $30\mu m$  less than  $35\mu m$ , less than  $40\mu m$ , less than  $45\mu m$ ).

Moreover, it is encouraged to control Y to  $12\mu m$  less than (less than the desirable west net is  $11\mu m$ , more preferably,  $10\mu m$ ) in order to the excellent conductivity secure with including the good workability.

The or more, and the equation.(2)It explained for the middle, and X (the content of the black additive) and Y (coating film thickness).

Moreover, it is not limited specially if the black can be given as the black additive is used for the present invention. The carbon black can be in come remarkably. The oxide of the fe, co, ni, cu, mn, mo, ag, sn etc, sulfide, the metal differentiation of the carbide or the black etc. can be used besides that. The most preferable thing the carbon black.

Here, the amount of addition (X) of the carbon black among film can be measured at with the method of less than.

Firstly, solvent is added to the subject (analysis sample) and it heats. The organic compound among the subject is decomposed. It is better that the kind of the solvent used dissimilars according to the kind of the base group resin. The proper solvent is used according to the solubility of each resin. However, the poly ester resin or the case of using the urethane resin for example increases the subject as the base group resin to the container (the recovery type flask etc) adding the NaOH – methanol solution. The hair clipper is heated to the water pass of 70°C. The organic compound among the subject is resentfuled.

Subsequently, this organic compound is hung by the glass filter (hole diameter 0.2 $\mu$ m). The carbon black density among the fixed quantity, and film are produced with the combustion infrared absorption method.

It is preferable that above statement, and the average particle diameter of the black additive it controls to 5~100nm. In the average particle diameter of additive is less than 5nm, the protection against heat characteristic as much as frame cannot be obtained and the stability of paint besides that bads and the coating appearance falls. In the meantime, the protection against heat characteristic falls if the average particle diameter is over 100nm. In addition, the outer tube is uneven after coating. Preferably, hereinafter more preferably over 10nm 90nm over 15nm 80nm or less. Moreover, the outer tube uniformity etc. are taken into account in addition to the protection against heat characteristic after the film stability, and coating to the total. If it is the case, it best suited of the black additive, the average particle diameter is encouraged to about 20~40nm.

Moreover, in the kind of the resin (the base resin forming exoergic film) added among film is the point of view of the protection against heat characteristic, it specially does not limit. The resin of these and acryl resin, urethane resin, the poly olefin-based resin, poly ester resin, fluorine-based resin, silicone resin etc. can be used appropriately. Mixes or changes. However, the invention coating is used as the frame body of the electronic device. Therefore the improvement of workability is required, the base resin suitable for the heat dissipation outside the walls. What the hydrophobic resin [the contact angle with the water specifically satisfies over 30° (over more preferably, 50°, more preferably, 70°)]. The resin satisfying this kind of the hydrophobic property can change according to the extent of the mixing times or denaturation etc. Therefore, for example, use including the mixing of the poly ester resin, the polyolefin resin, the fluorine-based resin, the silicone resin and thes or resin etc. desirables. Degenerated the use of the poly ester resin or degenerated poly ester resin (the thermosetting property poly ester resin or the unsaturated polyester resin including the poly ester resin etc. introduces the epoxy degeneration poly ester resin, and the phenol derivative to skeleton) is among them encouraged.

And it may be acceptable that in film, pigment including the inhibitive pigment, the silica etc. is added in the range that does not hurt the action of the present invention besides the black additive including the carbon black etc. In other words, the additive (, having the other heat dissipation except the black additive for example, TiO<sub>2</sub>In one kind or 2 kinds the , ceramics, ferric oxide, aluminium oxide, abortion barium, the silicon oxide etc, it can add in the range that at least, one kind) does not hatch the action of the present invention.

Moreover, in film, the cross-linking agent can be added. For example, the melamine based compound or the isocyanate-based compound etc. can be in come as the cross-linking agent is used for the present invention. It is encouraged to add these in one kind or 2 kinds, and the range of 0.5~10 weight%.

In this way, disclosed is the painted steel sheet which in the invention coating, the exoergic film containing the black pigment including the carbon black etc. is coated, and however, conventionally adds the black pigment including the carbon black etc. in the resin film.

For example, in JP3-120378 A, it is started about the manufacturing method of the far infrared ray radiation board (the thing in which the ceramic layer having the far infrared rays property in material is formed) used for the heating tool member. It is described as 「it goods even if the black pigment including the carbon black etc. is added in the predetermined black acrylic resin film. The radiating infrared is displayed with this, as to : the

amount of mixing, the resin 100 parts by weight 0.1~10 parts by weight, and the resin film thickness generally 0.1~5 $\mu\text{m}$  .

But the ceramic layer is formed in one side of material, the far infrared ray radiation board in gazette does more than. The heat dissipation as much as frame cannot be obtained because film is not formed like the invention painting plate in inside and outside side of substrate.

From the beginning, in both sides, the application object (use) differs. Therefore in the basis edge measure of the task solution means, the technical spirit dissimilars. The configuration condition each other dissimilars. That is, the far infrared ray radiation board on gazette is used for the field of the heating tool (remarkably, stove etc) in which the protection against heat characteristic under very high high temperature as about 200~300°C is required. Especially, the inner temperature generally at all does not intend like the invention coating about application to the electronic device member in which about 100°C is to the ambient temperature although about 40~70°C, and maximum. Therefore, in gazette, it has no about the conception for highing the emissivity of the far infrared rays emitted from the heating tool including stove etc. as long as it possible. The conception the carbon black is added consequently, of being put through to the so called 「heat penetration mode」 as the invention 「in order to drop the inner temperature of the electronic device, the calorie emitted from the electronic device is diffused the absorption → to the surface of the rear side → substrate of substrate」 for the heating tool. The room generating nearly has no.

Because of only one side being painted, the real, and the radiation plate check the dynamic range of emissivity and integral emissivity for the condition described in the invention. And the excellent protection against heat characteristic confirms like the invention with experiment to cannot obtain (the No. 19 described later of the table 5).

Moreover, in gazette, the Zn-Ni alloy plated steel sheet is to the base and it processes blackening and the black oxide finish is constituted. The radiating infrared at the hot zones is activated by coating the black resin film in the upper body. However, because of dissimilating, in the request characteristics, the state irrationaling the different kinds like that happens this kind of radiation plate in the invention with the difference of use it applies to the electronic device member (it is more used in comparison with the far infrared ray radiation board in the low temperature section) to object. That is, in ① heating tool use the electronic device member, the severe bending workability is required. Therefore the crack generates in the alloy plating layer. If this crack is to the start point and the residue of the black resin film or the plating comes off and it is omitted and the visual defect happens, the exfoliation like : ② this or the omission phenomenon happens inside the alloy plating layer, the residue of the film coming off or the plating accumulates in the part of the electronic device attach. Problem happens the concern in which the electronic device is out of order has.

Therefore, the invention and radiation plate think as the other invention.

It explained for the exoergicity film including or more, and black additive. The side exoergicity film one side at least mainly contain the black additive the exoergicity valuableness coated in the first coating in inside and outside side of substrate, and however, dissimilar are that the exoergicity film it is not limited to call on the invention to the additive ( 「the other heat dissipation additive」 having the black additive outer garment heat dissipation the protection against heat characteristic as much as the frame of deciding is satisfied is formed in this. Of course, coating the particularly desirable mode having the black additive containing exoergicity film satisfying relationship inside and outside of substrate.

Here, 「the other heat dissipation additive」 , for example, TiO<sub>2</sub>In one kind or 2 kinds the , ceramics, ferric oxide, aluminium oxide, abortion barium, the silicon oxide etc, at least, one kind can be in come. It is preferable that the coating film thickness of the exoergicity film containing this 「the other heat dissipation additive」 according to kind or the use of 「the other heat dissipation additive」 used etc, the proper coating film thickness can be established in order to obtain the protection against heat characteristic as much as frame. However, it to about approximately, 1~30 $\mu\text{m}$ .

Specifically,  $\text{TiO}_2/\text{TiO}$  among film in the case of the contain degree film. If the film which contain 2 about 40~60% is constituted about 25~30 $\mu\text{m}$ , approximately, the infrared ray radiation rate of 0.8 either before or after can be obtained. The infrared ray radiation rate more and more grows larger if and, and, the carbon black, including, the black additive etc. are added among film. Moreover, the Al flake etc. are added among film approximately, 5~30% when to enforcing the film of the metallic color outer tube. Lower-part, and the infrared ray radiation rate of about 0.6~0.7 can be obtained from about 5~30 $\mu\text{m}$ .

(b) About the coating (the the second coating) for the electronic device member with a superior emissivity and magnetic cooling nature.

The second coating shows as the index showing 「the excellent magnetic cooling nature」 in coating the exoergic film having moreover, substrate, at least, the heat dissipation in the surface film is coated in inside and outside side of substrate is coated for below (III)  $\Delta T_2$  (The extent of the temperature rise suppression of the coating itself) In other words, the equation shown for below (IV) (4)  $[b \leq 0.9(a - 0.05)]$  As the index showing ; moreover, the second coating 「the excellent heat dissipation」, the equation (5)  $[(a - 0.05) \times (b - 0.05) \geq 0.08]$  shown is satisfied with below (V).

Firstly, it explains for the index of the magnetic cooling nature.

The duplex.  $\Delta$  it is decided as the index showing the thermal performance transferring the heat absorbed into coating to the open air side (4) highs the infrared ray radiation rate of the surface in comparison with the infrared ray radiation rate of the rear side.  $T_2$  decides the thermal performance at the coating of the practical level holding a conference the electronic device member use.

In this way, both sides usefals as the index showing the everyone 「the magnetic cooling nature」. And it has with the good correlation. For your reference, the graph plotting the result of the working example which will be described later was shown for the fig. 6. The longitudinal axis of the fig. 6 is the equation. Among the equation  $(0.9a - b \geq 0.05)$  transfiguring (4), the calculation value (it hereinafter represents to Q value) of the left side  $(0.9a - b)$ .

According to the second coating satisfying this kind of the magnetic cooling nature, the temperature rise of the coating itself could be controlled. Therefore, when this coating was used as the frame body of the electronic device, even if agent touched in the electronic device driving 「it does not hot」, it feels. When looking at in agent, the safe electronic device can be offered. Moreover, the electronic device member which includes these positive temperature coefficients since coating combines with the good heat dissipation very usefals in that more bring the enlargement of the new use.

Hereinafter, it explains for each property of (III) ~ (V).

(III)  $\Delta T_2 (= T_{2B} - T_{2A}) \geq 0.5^\circ\text{C}$

Here, t: T the coating temperature 2A using the heat dissipation automated test equipment shown for fig. above-described 1, and when measuring the invention coating as the advertise ash. 2B similarly uses the heat dissipation automated test equipment of fig. 1. The substrate temperature when using the substrate in which film is not coated as the advertise ash is implied respectively. Moreover,  $\Delta T_1$  measured like the description of the first. And the difference ( $\Delta$  when using the dance hall disk that does not enforce temperature and the film when using the advertise ash of temperature  $T_2$  it produced.

Moreover,  $\Delta T$  The middle high limit, and  $\Delta$  as to the invention the mean of data of three-point except for the limit inferior 2 measures as to each advertise ash 5 time.  $T_2$  it decided.

△.T△ in the invention 2 compares in case of using the substrate (the disk in which film is not coated).TThe heat dissipation automated test equipment of the invention audience shown for especially, fig. 1 was used as the apparatus for measuring 2.

△ the excellent magnetic cooling nature is obtained.TIt desirables as 2 bigs. △TTo the desirable west net of 2 over 1.0°C over 1.5°C over 2.0°C 2.5°C or greater.

(IV) equation (4):  $b \leq 0.9(a - 0.05)$

In the formula, the road in (II) which the method of measurement of the meaning of a and b and infrared ray integral emissivity mention above.

As soon as it mentions above, it usefuls as the index of 「the magnetic cooling nature」 which the equation (4) controls the temperature rise of the coating itself. The magnetic cooling nature (△ as much as frame under the technical spirit which the equation 「the film highing the infrared ray radiation rate of the surface (open air side) of substrate in comparision with the rear side (electronic device inside) of substrate is enforced. In that way the temperature rise of the coating itself is controlled」.T2The relational expression of the infrared ray radiation rate securing  $\geq 0.5^\circ\text{C}$ ) of the surface · rear side is specified.

In case coating is used as the frame body of the electronic device, if the infrared ray radiation rate of the frame body inner surface (rear side) is enhanced, the infrared ray absorption volume emitted within the electronic device from the heating source increases. The temperature of the coating itself rises. In the meantime, if the emissivity of the frame body external side (surface) is enhanced, the infrared ray emission amount emitted from coating to outside increases. The temperature of coating falls. It does an experiment based on this kind of point of view all kinds of and the invention decides the equation. The calorie emitting from the front surface side of substrate grows larger according to the invention than the calorie which is in the backside of substrate the absorption (radiation). Therefore, the temperature rise of the coating itself is controlled high efficiency.

In this way, the protection against heat characteristic forms the other film on the surface and rear side of substrate. While the level of the protection against heat characteristic is kept to some extent, because of the new thing which it does not inform convention, coating thinks. In which the temperature rise of coating in the meantime suppresses and which becomes.

Therefore, in the second coating, the magnetic cooling nature excellent as the difference of the infrared ray radiation rate of a and b big can be obtained. Specifically, it desirables as Q value (=  $0.9a - b$ ) bigs. To the desirable west net over 0.13 over 0.24 over 0.35 0.47 or greater.

(V) Equation.(5):  $(a - 0.05) \times (b - 0.05) \geq 0.08$

Equation.The protection against heat characteristic (△ the calculation value (it hereinafter represents to R value) of the left side  $[(a - 0.05) \times (b - 0.05)]$  bigs (5) specifies the index of the protection against heat characteristic as to the second coating with of the infrared ray integral emissivity of inside and outside side.T1It shows that it excellents. The desirable limit inferior is the west net 0.35(△.T1About  $2.6^\circ\text{C}$ ), and 0.52(△.T1The net of about  $3.5^\circ\text{C}$ ).

This the equation.(5) mentions above △.T1( It has with 「the difference of the electronic device inner temperature」 explained as the first coating and the good correlation. For your reference, the graph plotting the result of the working example described later was shown for fig. 7.

The level (△ of the protection against heat characteristic as to the second coating.T1△ it changes into.T  $\geq 1.5^\circ\text{C}$ ) is the level (△ of the first coating.The tolerance range widens in comparision with  $T \geq 2.6^\circ\text{C}$ ). In this is the second coating, the improvement of the magnetic cooling nature is in come about the major task to solve.

As long as this subject is accomplished, as to the level of the protection against heat characteristic, the form which a little bit lows in comparison with the first coating decides based on the point of view of including.

Next, it explains for the concrete composition for obtaining the second coating.

The exoergicity film having and, substrate, at least, the heat dissipation in the surface in coating, film is coated in inside and outside side of substrate is coated. The equation the magnetic cooling nature as much as frame is secured thing is necessary.(5) need to be satisfied. In this way, in the second coating, because the level of the protection against heat characteristic required from the surface · rear side dissimilars, less than, and the case are divided and it explains.

Firstly, the coating 「the exoergicity film of the surface」 of the second equation comprises the form of (ii) or less (i).

( i ) The form which mainly adds the black additive, and controls the black additive (X) contained in the exoergicity film to relation with the coating film thickness (Y).

In the case, adding the black additive in the film of the surface, and highs the protection against heat characteristic. The amount of addition (X) of the black additive and coating film thickness (Y) the following equation.It is better that X and Y are controlled appropriately in order to satisfy (6). Specifically, it thes same like below ④ ~ ⑥.

④ Equation.(6): $(X - 3) \times (Y - 0.5) \geq 3$

Equation.(6) is the target level ( $\Delta$  of the heat dissipation as to the second coating.The relational expression of Y and X for materializing  $T \geq 1.5^{\circ}\text{C}$ ) is decided. The protection against heat characteristic excellent as P value [=  $(X - 3) \times (Y - 0.5)$ ] bigs gets. The desirable west net over 7 over 11 over 15 over 30 50 or greater.

However, the protection against heat characteristic is saturated even if P value is overly a lot., in addition waste the invention coating is used as the frame body of the electronic device and it is required, workability and conductivity etc. are economically encouraged the high limit of P value to the only which only amount including the black additive etc. increases uses to the desirable west net to control to 240, 200, 150, 100.

Moreover, equationThe equation which the limit inferior of (6) decides in the first coating.It smalls in comparison with the lower limit of (2). Since as to the protection against heat characteristic level of the second coating, the a little bit low form can include, in this, the tolerance range is due to wide in comparison with the first coating.

⑤ Equation.(7):  $4\% \leq X < 15\%$

The content X of the black additive 3% excess to premise. It is encouraged to over 4%. The thing, the activating 「 $X > 3\%$ 」 to premise is the equation. $(X - 3)$  is due to be necessary what the gad ( $>0$ ) the coefficient of the left side of transplant in order to satisfy (6).

Moreover, the limit inferior of X obtains the excellent protection against heat characteristic. Simultaneously, it is decided in order to secure the property (lacquerability, the outer tube etc) of the coating itself. The property as much as frame cannot be obtained from 3% or less. The desirable limit inferior 5%, 7%, 8%, 10%. In the meantime, in the high limit of X is relation with the protection against heat characteristic, it is not limited specially. However, if it becomes over 15%, lacquerability grows worse and the coating stain happens and the visual defect generates. Therefore, the desirable high limit considering lacquerability etc. under 15% 13%, and the net of 11%.

⑥  $Y > 1\mu\text{m}$

It 0.5 $\mu$ m excess to premise. It encourages 1 $\mu$ m excess. The thing the activating 「Y > 0.5 $\mu$ m」 to premise is the equation. It is due to be necessary that (Y - 0.5) is the gap (>0) the coefficient of the left side of transplant in order to satisfy (6).

The limit inferior of Y is decided in order to specially obtain the protection against heat characteristic. The thermal performance as much as frame cannot be obtained even if Y very much adds the black additive in 0.5 $\mu$ m or less. The desirable limit inferior the net of 3 $\mu$ m, 5 $\mu$ m, 7 $\mu$ m, 10 $\mu$ m.

Moreover, in the high limit of Y is relation with the protection against heat characteristic, it is not limited specially. However, the invention coating intends the application of the electronic machinery part. It is encouraged to control in the point which the relation phase with the accessibility, and the improvement of workability are required in especially, the bending time in consideration of the crack or the exfoliation of film, including, the generating prevention etc. to 50 $\mu$ m less than (less than the west net desirably is 30 $\mu$ m less than 35 $\mu$ m, less than 40 $\mu$ m, less than 45 $\mu$ m).

Moreover, it is encouraged to control Y to 12 $\mu$ m less than (less than the desirable west net is 11 $\mu$ m, more preferably, 10 $\mu$ m) in order to the excellent conductivity secure with including the good workability.

(ii) The form which mainly adds the other additive except the black additive.

The case, of using the other additive except the black additive in order to enhance the protection against heat characteristic of the surface coat is the other additive, for example, TiO<sub>2</sub>, ceramics, ferric oxide, aluminium oxide, barium, the silicon oxide etc can be in come. These can use one kind or 2 kinds. Moreover, it may be acceptable that the black additive including the carbon black etc. is added. In order that the coating film thickness of the exoergicity film obtains the protection against heat characteristic as much as frame, the proper coating film thickness can be decided according to the kind of the additive which use etc. but it is encouraged to roughly roughly to about 5~30 $\mu$ m.

Specifically, in case of the contain degree film, the titanium oxide is added among film approximately, 50~70%. It is encouraged to the coating film thickness to about 25~30 $\mu$ m. Moreover, the Al flake etc. are added approximately, 5~30% when to enforcing the film of the metallic color outer tube. It is encouraged to the coating film thickness to about 5~30 $\mu$ m.

Subsequently, it explains for the second coating 「the film of the rear side」 related to the invention. In order to secure the excellent magnetic cooling nature, 「the film of the rear side」 need to the exoergicity film. But 「the film of the rear side」 can obtain the property as much as the frame of saying in the second coating. The need to certainly certainly to the exoergicity film has no. That is, the equation 「one side painted steel sheet」 in which film is not enforced in the second coating on the rear side of substrate is not included (as to the infrared ray radiation rate of the disk, having no film the magnetic cooling nature as much as frame cannot obtain from about 0.04) The arbitrary film can be adopted as long as (4) is satisfied.

Specifically, the other additive except the above-described black additive · black additive is jointly used as the singleness. The amount of addition and coating film thickness are adjusted appropriately according to the emissivity of the surface coat and the film of the rear side can be formed. Moreover, when the film of the rear side is formed by using the black additive, the relation of Y and X certainly mentions above(6) If only the infrared ray radiation rate of the surface coat appropriately controls without the need to satisfy equation although it continues the film (P value described in the above is 0 under) without the heat dissipation, the magnetic cooling nature as much as frame can be secured (reference the No. 1 of the table 6 and 11).

Or the film which at all does not add additive and controls the coating film thickness to the fixed range (over about 2.5 $\mu$ m) can adopt (reference the No. 3 of the table 6 and 7). The some protection against heat characteristic be obtained from the resin contained among film.



Specifically, for example, it is better that the case of using the poly ester resin of hydrophobic as the coating film formation resin adjusts the coating film thickness over approximately,  $2.5\mu\text{m}$ .

The basic configuration was explained as to the second coating related to the or more, and the invention for the additive dissimilarizing the black additive / forming the film of the surface · rear side. Besides that, as to film, the kind of the resin added among the kind : film of the other additive except the kind of the black additive used or the average particle diameter : black additive or additive etc. the road explaining in the above-described the second coating.

(c) About the coating (the the third coating) for the electronic device member which moreover, the conductivity enhances as to the coating of (b) and (a).

As to the third coating, related to the invention moreover, the conductivity excellents. The electric resistance  $100\Omega$  or less is established as the index. Preferably,  $10\Omega$  or less.

Here, the method of measurement of the electric resistance is same as those of hereinafter.

The Mitsubishi Chemical product 「Ioresta EP」, and probe used the Mitsubishi Chemical product 2 probe probe (MCP-TP01) as the conductivity measure system. As to measurement, in order to go the thickness  $0.8\text{mm}$ , and the copper coil of the size  $20\text{mm}$  angular between probe and measurement sample of probe the copper coil among and it each other did not touch 2 field was left. The resistance ( $\Omega$ ) of the advertise ash was measured.

In this way, in order that the coating with a superior conductivity is obtained, the task which contain the conductive pillar (filler) among the film of the surface and/or the rear side 10~50% is necessary. Moreover, in the invention coating, film is altogether coated the coating of the first coating · second in inside and outside side of substrate. If the conductive pillar is added in both parties of the rear side and surface, the very excellent conductivity can be obtained. It goods even if the conductive pillar is added according to use in one side. The predetermined conductivity can be secured with this.

Here, the metal compound including the metal simple substance : FeP of the ag, zn, fe, ni, cu etc etc. can be in come as the conductive pillar is used for the present invention. Among them, particularly, ni what desirable. Moreover, the shape is not particularly limited. It is encouraged to use the thing of the flake in order to obtain the more excellent conductivity.

Moreover, the content of the conductive pillar about forming component of coating film (the component everyone forming the film which the additive added according to the cross-linking agent added besides the base resin including the polyester resin etc. according to need or the black additive and conductive pillar and need includes is implied) 100 % (solid conversion) to 10~50%. In less than 10%, effect as much as frame cannot be obtained. Preferably, more preferably more preferably over 15% over 20% 35% or less. In the meantime, workability falls if the content of the conductive pillar is over 50%. Particularly, in case of applying to the site in which the marked bending workability is required like the coated metal sheet, it is encouraged to 45% this harrow. More preferably, more preferably less than 40% 35% or less.

It mentioned above about the film characterizing the or more, and the coating of the present invention. As soon as it mentions above, the critical point of the present invention has to specify the configuration of film. It is not limited specially about substrate except film. Therefore, in ① as the substrate is used for the present invention, remarkably, the metal plate, and the extrinsic which specifically altogether can apply all kinds of the plated steel sheets of the cold rolled steel, hot rolled steel sheet, electrolytic galvanized iron (EG), molten galvanizing steel plate (GI), alloying melting zinc galvanized steel (GA), 5% Al-Zn plated steel sheet, 55% Al-Zn plated steel sheet, al etc, the stainless steel panel, including, the steel board class or the publicly known metal plate etc, the wire, bar, pipe material, the ceramic material etc specifically can come in substrate except ② metal plate. The metal material of the metallic board etc with a superior double, and the desirable thing is the thermal conductivity, and the ceramics.

Moreover, even if the improvement of corrosion resistance, the adhesion improvement of film etc. to purpose and its surface-processes of the chromate treatment or parkerizing etc., the metal plate of ① goods. However, it goods even if the field chromate treatment heartburnings metal plate is used in consideration of the environmental contamination etc. The double any kind of form is included in range of the present invention.

Here, it explains for the configuration of the invention coating uses the field chromate treatment heartburnings metal plate.

Firstly, the primer treatment of chromium-free need to become substrate and moreover, the exoergicity film (at least, the surface) contain need to the rust preventive. Generally, the use of the rust preventive is due to be indispensable to the object of the improvement of corrosion resistance the field chromate treatment is.

Here, it is better that 「the primer treatment of chromium-free」 is not particularly limited. It underlies. It is commonly used. Specifically, the primer treatment of the phosphate system, silica-based, the titania type, zirconium-based etc is encouraged independently in other words to use jointly and do.

Moreover, the silica-based compound, phosphate system compound, phosphite system compound, polyphosphate group compound, sulfur meter organic compound, benzotriazole, tannic acid, moly Putin acid salts system compound, tungstate system compound, vanadium system compound, the silane coupling agent etc can be in come as the rust preventive. These can be jointly used independently in other words. Particularly, the silica-based compound (for example, the calcium ion exchange silica etc) and phosphate system compound, the phosphite system compound, and the parallel use of the polyphosphate group compound (for example, the tri barley aluminium phosphate etc). And what desirable it is encouraged to use jointly silica-based compound : (the phosphate system compound, and the phosphite system compound or the polyphosphate group compound) to the mass rate in the range of 0.5~9.5 : 9.5~ 0.5 (more preferably, 1 : 9~9 : 1). The corrosion resistance as much as frame and workability everyone can be secured by controlling to this range.

Moreover, it may be acceptable that these rust preventives uses in the primer treatment described in the above.

According to the use of the rust preventive, the corrosion resistance is secured. However, it is in the meantime known as that workability is demoralized according to the addition of the rust preventive. And in the invention, it takes a caution as the formation component of the exoergicity film about especially, the combination of the cross-linking agent and resin. The poly ester resin introduced and the to mix and use the cross-linking agent (preferably, the isocyanate system resin and/or the melamine resin, more preferably, the parallel use of both sides). Thing are encouraged the epoxy degeneration poly ester resin and/or the phenol derivative to skeleton.

The poly ester resin (the poly ester resin etc. introduces for example, the bisphenol A to skeleton) introducing the double, and the epoxy degeneration poly ester resin and phenol derivative to skeleton are superior to the poly ester resin in the corrosion resistance and coating adhesiveness.

In the meantime, the isocyanate system cross-linker has the workability enhancement activity (the outer tube enhancement activity after processing is implied. It evaluates in the working example described later as the number of crack at the adhesion bending test). And even if the rust preventive was added accordingly, the excellent workability is secured.

Moreover, the melamine based crosslinking agent was known the detection result of these inventors to have the excellent corrosion resistance. Therefore, in the invention, by using jointly with the above-described rust preventive the good corrosion resistance can be obtained very.

In the invention, it goods even if the isocyanate system cross-linker and melamine based crosslinking agent are used independently. However, workability and corrosion resistance can be improved more and more if both is jointly used. Specifically, the melamine resin is about the isocyanate system resin 100 mass unit to the rate of 5~80 mass unit, it is encouraged to. In case of the melamine resin is 5 mass unit under, the corrosion resistance as much as frame cannot be obtained. If the melamine resin is over 80 mass unit, effect by the

addition of the isocyanate system resin is good, it is not displayed. And the workability enhancement activity as much as frame cannot be obtained. More preferably, more preferably about the isocyanate system resin 100 mass unit over 10 mass unit less than 40 mass unit over 15 mass unit 30 mass unit or less.

Moreover, it explains in 「coating composition」 saying later about the rate of the conductive pillar and the resin, rust preventive, cross-linking agent, black additive comprising the above-described forming component of coating film.

In coating, the corrosion resistance, and the coating adhesiveness and workability excellents satisfies this kind of configuration. Specifically, the outer tube phase shift unit (film bulge in the salt spray test corrosion test (72

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hours) ruled about the corrosion resistance in JIS-Z-2371, and the rust (The area rate of the) including the) etc. satisfies 10% less than (less than more preferably, 5%). The property appropriately controls the kind of the cross-linking agent (the useful melamine based crosslinking agent for for example, the improvement of corrosion resistance is fixed quantity added independently) used, or by adopting the configuration of the etc. to 2 layer film enforcing the film (preferably, the clear film) to the purpose of controlling the elution of the rust preventive on film it is more and more enhanced. The area rate more than the outer tube satisfies 10% less than (less than more preferably, 5%) through the consequently more severe test [the salt spray test corrosion test (120 hours) ruled in JIS-Z-2371].

Moreover, as to coating, the coating adhesiveness and workability excellents. In the activating 「coating adhesiveness」 「workability」, the together 「the outer tube after processing excellents」 has the nature commoning in the point. However, it evaluates in the invention as the especially 「workability」 「the crack (it splits) number in the intimate bending test ruled in the JIS K 5400」. And it in the meantime evaluates as 「coating adhesiveness」 「the coating adhesiveness of the part processed」 (in the invention coating, the number of crack in the intimate bending test more preferably more preferably satisfies 0 less than 5 less than 2).

And if the conductive pillar is added among film in case of the and besides conductivity to securing with property (the corrosion resistance, and the coating adhesiveness and workability), it goods. The electric resistance can be controlled accordingly less than 100Ω. As the desirable form of the conductive pillar used mentions above. Moreover, the corrosion resistance falls if the conductive pillar is added among film. By controlling the film thickness of film over 2μm although the chromium-free drawing tall lice, the corrosion resistance and conductivity everyone can be secured. More preferably, more preferably over 3μm 5μm or greater. In the meantime, as the high limit mentions above, it is encouraged to control to 12μm less than (less than more preferably, 10μm).

It explained for the invention coating used the or more, and the field chromate treatment heartburnings metal plate.

The invention coating so far the single story film configuration in which film is enforced on substrate. However, it explains in the form of the coated double layer film configuration, film is again included in the invention in the upper part over one kind or 2 kind. Particularly, in the invention, in case the granting of the anti-finger printing and my crack nature is attention to paid and the black film is used specially, it is encouraged to 2 layer film configuration enforcing the clear film to this black film. The black film is painted to the black of the rich color system. Therefore if it treats as the hand, the disadvantage of easing is undertaken that fingerprint is seen in the eye and the surface property falls. The anti-finger printing betters if the clear film is formed. Moreover, the advantage that this crack is not seen in the eye by enforcing the clear film even if the crack even if happened in the black film, has.

Here, it importants to control the coating film thickness of the clear film in order to improve my crack and anti-finger printing even when keeping the property (the protection against heat characteristic / magnetic cooling

nature) as much as frame. However, in case of the conductivity excellenting the and besides including, the desirable range of this clear coating film thickness changes with the heat dissipation.

That is, in case of coating does not add the conductive pillar in film, it is encouraged to control the coating film thickness of the clear film to  $0.1 \sim 10 \mu\text{m}$  in order to plot moreover, the improvement of the anti-finger printing and my crack while keeping the excellent protection against heat characteristic / magnetic cooling nature. In less than  $0.1 \mu\text{m}$ , the enhancement activity of the anti-finger printing and my crack cannot be obtained. More preferably, more preferably over  $0.2 \mu\text{m}$   $0.3 \mu\text{m}$  or greater. However, even if the coating film thickness is exceeded  $10 \mu\text{m}$  and it thickens, the enhancement activity including my crack etc. becomes saturated. Therefore, profitability has no to the only which only the film cost increases. Therefore it goods to the high limit to  $10 \mu\text{m}$ . More preferably, more preferably less than  $8 \mu\text{m}$   $7 \mu\text{m}$  or less.

In the meantime, in case of coating adds the conductive pillar in film, the conductivity which is good the and besides is kept with the protection against heat characteristic / magnetic cooling nature. The task plotting the improvement of the anti-finger printing and my crack is necessary. It is encouraged for that to control the coating film thickness of the clear film to  $0.1 \sim 3.0 \mu\text{m}$ . In less than  $0.1 \mu\text{m}$ , the enhancement activity of the anti-finger printing and my crack cannot be obtained. More preferably, more preferably over  $0.2 \mu\text{m}$   $0.3 \mu\text{m}$  or greater. However, it is preferable that the coating film thickness if it so thickens, the bad effect is mad gone on the conductivity. Therefore the high limit is to  $3.0 \mu\text{m}$ . More preferably, more preferably less than  $2.0 \mu\text{m}$   $1.5 \mu\text{m}$  or less.

As described above, the formation of the clear coating film is very effective in comparison with the single layer film structure which is to the film singleness by to 2 layer film structure coating the clear coating film on film, in the point which the anti-finger printing improvement which it could not accomplish can obtain from this single layer film structure with markedly improving my crack nature.

Here, the resin forming the transparent. Film which is not particularly limited as the resin comprising the clear film, and is altogether included. Specifically, the mixture of the resin of the acryl resin, urethane resin, polyolefin resin, poly ester resin, fluorine-based resin, the silicone resin etc and these resins or resin etc. can be in come changes. Moreover, it may be acceptable that in the range that does not hatch the action of the present invention among the clear film, additive including the cross-linking agent, the wax, the chlorine agent etc. is added. Accordingly, lubrication and the strength of film etc. can be adjusted easily. My crack nature about the scar generation be enhanced consequently more. It is commonly used as the additive is used for the present invention among film. It is not limited if action can be displayed tellingly. For example, the cross-linking agent including the melamine based crosslinking agent, the blockisocyanate system cross-linking agent etc. can be in come.

Moreover, as it mentions above, the thing of the plurality film configuration in which the film which is not the clear film is enforced is included in the coating of the present invention. However, the colour pigment, including, pigment etc. can be added again in resin and the additive comprising the above-described clear film in this case.

And in the invention, the coating composition which contain 3 weight part excess and conductive pillar 10~50 mass unit is included the black additive about the forming component of coating film in range of the present invention. Here, the road because requisite (preferably the carbon black. And the thing controlling the average particle diameter to  $5 \sim 100 \text{nm}$ , and the relation of the coating film thickness and content are encouraged to satisfy the relation of the above-described equation) of the black additive and requisite (preferably, Ni) of the conductive pillar state before. Since forming the film with a superior heat dissipation and conductivity it uses, especially, the coating for the electronic device member can be used appropriately as the paint for obtaining.

Moreover, as the coating composition applied to the substrate in which the chromium-free system primer treatment is enforced, the coating composition which contain 3 weight part excess and conductive pillar 10~50 mass unit is included 1~20 mass unit (less than preferably, 18 mass unit over 2 mass unit, more preferably, 15 mass unit over 3 mass unit), and the black additive in range of the present invention introduces the epoxy degeneration poly ester resin and/or the phenol derivative to skeleton. As the double, the desirable requisite (the

thing which the melamine based crosslinking agent is about the isocyanate system cross-linker 100 mass unit to the rate of 5~80 mass unit, it preferably preferable) of the cross-linking agent, and the desirable requisite of the black additive and the desirable requisite of the conductive pillar mention above. The chromium-free system film with a superior heat dissipation, the conductivity, the corrosion resistance, the coating adhesiveness and workability it uses can be formed. Therefore, the coating for the electronic device member can be used appropriately as the paint for obtaining as especially, the paint for the chromium-free coating.

Next, it explains for the method for manufacturing the coating of the present invention. The coating of the present invention spreads the paint containing component to the publicly known coating method in the surface of substrate. It desiccates and it can manufacture. The coating method is not particularly limited. However, the surface is purified and by using the roll coater method, spraying, the curtain after furnace coater method etc., paint is painted for example according to need in one elongated metal web surface. Method etc. can be in come. In which the hot blast drying furnace is through passed and which it desiccates. If uniformity or the processing costs of the film thickness, the paint efficiency etc. is taken into account to the total, the roll coater method what desirables the utility phase.

In the meantime, in case the resin coating metal plate is used as substrate, it irrelatives even if parkerizing or the chromate treatment is to the purpose in improvement of adhesion with the resin film or the corrosion resistance as the coating preprocessing. However, in the point of view of the chromium releasing of the resin coating busy about the chromate treatment material, it goods to control the Cr bond quantity in the chromate treatment 35 mg / m<sup>2</sup> this harrow. This range. If it is the case, the chrome elution at the summer solstice chromate treatment layer be controlled. Moreover, according to the conventional chromate treatment material is need, the tendency that for the domestic demand adhesion of the common way coating, 6 falls according to the elution of the chrome as to damp environment has. However, the things in which the domestic demand adhesion of the common way film is aggravated because elution is controlled at the metal plate has no.

The coating of the nonchromate type can be obtained in other words if the primer treatment of the above-described chromium-free is enforced with the roll coater method, spraying, and the soaking light of Buddhism.

In the meantime, in the invention, the electronic machinery part having within the heating element in the closed space. In as to this electronic machinery part, the electronic machinery part consisting of the coating for the electronic device member, a part is all in other words included of the exterior wall. The AV machine : copy machine of the electrical & electronics · communications related product : projector, the television, video, the game console etc, printer, including, the copy machine : air conditioner outsider, including, the power box cover, the control box cover, the vending machine, refrigerator etc including the information write product : personal computer of the CD, LD, DVD, CD-ROM, CD-RAM, PDP, LCD etc, the car navigator, the car AV etc. can be in come as the electronic machinery part.

Moreover, in the invention, a part is all in other words composed of the heat dissipation automated test equipment for evaluating the heat dissipation of the test board of the ceiling surface of the subject. In the side and bottom surface, the heating element are installed in the bottom surface of the upper body. Consisting of the insulating material the heat dissipation automated test equipment establishing the temperature measuring apparatus is included within moreover, the upper body in approximately, the central part in range of the present invention. Fig. above-described 1 the representative example. Moreover, influence including the wind etc. is avoided. Originates in outside or resonator etc. the desirable mode to establish the shielding member secluded from the open air condition in the purpose of obtaining stable data in the upward of the test board.

The representative example of this kind of apparatus was shown for the figures 8 and 9. As to the double, and fig. 8, : drawing 9 respectively show the schematic diagram of the heat dissipation automated test equipment for covering the upper body front side with the shielding member for partly covering the upward of the upper body with the shielding member. As shown in Figure 9, it usefult since completely secluding influence by outside. Of course, these apparatuses does not pass by through the representative example. Is ever not. What is limited to these apparatuses.

Among the drawing, as to as to as to as to the denotation (1), the subject (the sample which wants to evaluate the heat dissipation), and the denotation (2), the insulating material, and the denotation (3), the heating element, and the denotation (4), the shielding member (cover), and the denotation (5) the temperature measuring apparatus. The heat dissipation automated test equipment of the present invention has with the box shape structure. And the side and bottom surface are composed of the insulating material (2). For the heating element (3), the temperature measuring apparatus (5) installs in the bottom surface of the upper body within the upper body in approximately, the central part. The outside of the apparatus is covered with the shielding member (4). Moreover, the open air condition is constant and as to the case, of measuring the installation of the shielding member unnecessary. Fig. above-described 1 to show the form. The shielding member specially does not limit material if it can seclude outside. For example, for example, the plastic, the wooden material, the metal material etc. is usable.

It is encouraged to appropriately control the location so that the temperature measuring apparatus (5) accurately measure the ionic degree at the apparatus for measuring the ambient temperature of the inside of device. Specifically, H the straight line (mm) which most in a long queue can \*\*\* in the heating element (3) installed at bottom surface the low area (mm<sup>2</sup>) of L : heating element (3) in S : heating element (3) the height (mm) to the temperature measuring apparatus (5) These is L / H = 0.7~2 the height (mm) to the subject (1) was in : heating element (3) H clitoris 8: s / H.2= 0.25~4 ; HTIt is encouraged to control in order to satisfy the relation of the / H = 0.3~0.7. If these ranges is escaped, the precision of data is due to fall. For your reference, L in fig. 10, S, and HTAnd relation with H was shown.

Hereinafter, the invention be above mentioned in detail with the working example. However, the following embodiment does not restrict the invention. Moreover, it is altogether included in the invention to differently implement in the range that does not deviate the purport of the present invention.

Working example.

The following embodiment 1~4 evaluates the various kinds characteristic about the coating of the first / third around the protection against heat characteristic related to the invention. The double, and the working example 1~3 spread the same paint of amount in inside and outside side of substrate. It enforces for coating. And it enforces in order to form the exoergicity film of the isopachous it varies kind or the amount of the paint added in inside and outside side of substrate etc. and the working example 4 enforces for coating. Emissivity forms the other exoergicity film on inside and outside side.

Working example 1: the evaluation of the heat dissipation at the first coating (the addition nothing of the conductive pillar).

In the present preferred embodiment, the heat dissipation of the first coating was evaluated related to the invention.

Firstly, the electrolytic galvanized iron (board thickness 0.6mm) was to disk. After the paint (the polyester resin is used as the base resin. The melamine resin is used as the cross-linking agent) adding same amount the carbon black (average particle diameter 25nm) of the predetermined amount which showed for the table 1 was spread in the inside and outside side, it dried with stoving and each advertise ash (120 ×150mm) of the No. 1~23 was manufactured. And the disk of the dance hall which did not spread paint was processed for comparison like this.

The integral emissivity of the method which mentions above the apparatus of fig. 1 is used about each advertise ash obtained in this way the infrared ray (wavelength : 4.5~15.4μm) and  $\Delta T_1$  [No. The difference when using the advertise ash (dance hall disk) of the comparative example when using each advertise ash of 1~32 and temperature of temperature] It measured. Moreover, the infrared ray radiation rate juxtaposes data when heating with 100°C and data when heating with 200°C.

Moreover,  $\Delta T$  The thing with a superior protection against heat characteristic it bigs if 1 bigs was shown. However, it made on a curve to below standards. And in the first coating related to the invention, coating is

evaluated as 「the excellent heat dissipation is displayed as to coating」 .



◎ :  $3.5 \leq \Delta T1$



:  $2.7 \leq \Delta T1 < 3.5$



:  $1.5 \leq \Delta T1 < 2.7$

△ :  $1.0 \leq \Delta T1 < 1.5$

× :  $\Delta T1 < 1.0$

With juxtaposing the result getting in the table 1, relation with the amount of addition (X) of the carbon black and coating film thickness (Y) are shown for fig. 12 the graph. Among the drawing, the evaluation standard is



implied.

Table 1.

P 수치	방사율				방열성	
	표이면		a x b		ΔT1 (°C)	상대평가
	100°C	200°C	100°C	200°C		
-1.5	0.10	0.11	0.01	0.01	0.5	x
-0.75	0.15	0.15	0.02	0.02	0.8	x
15	0.75	0.77	0.56	0.59	3.3	●
23	0.79	0.81	0.62	0.68	3.4	●
35	0.78	0.81	0.61	0.66	3.4	●
18	0.74	0.75	0.55	0.56	3.4	●
30	0.80	0.81	0.64	0.66	3.6	◎
46	0.81	0.83	0.66	0.69	3.7	◎
70	0.82	0.84	0.67	0.71	3.8	◎
17.5	0.65	0.66	0.42	0.44	2.7	●
31.5	0.80	0.81	0.64	0.66	3.5	◎
52.5	0.80	0.82	0.64	0.67	3.7	◎
80.5	0.83	0.85	0.69	0.72	3.8	◎
122.5	0.86	0.88	0.74	0.77	3.9	◎
40.5	0.80	0.80	0.64	0.64	3.6	◎
67.5	0.81	0.82	0.66	0.67	3.8	◎
103.5	0.83	0.85	0.69	0.72	3.8	◎
157.5	0.83	0.86	0.69	0.74	3.9	◎
16.5	0.70	0.72	0.49	0.52	3.3	●



In the table 1, whereas in the coating (No. 1~2) which does not satisfy the requisite of the present invention, the protection against heat characteristic is altogether behind, in the coating (No. 3~23) satisfying the requisite of the present invention, the protection against heat characteristic altogether excellents.

Moreover, in the table, it does not appear. However, in case X, and the desirable range (15%) of the present invention are over and the content of the carbon black is to 18%, it thicked to 1, 10, 18 $\mu$ m and the coating film thickness Y was controlled to range  $[= (X - 3) \times (Y - 0.5) \geq 15]$  of the equation (2) but the coating stain clears. It confirms that the task which it uniformly spreads difficult.

Working example 2: the evaluation of the heat dissipation at the third coating (the additional oil of the conductive pillar) and conductivity.

In the working example 1, except for using paint a (the composition of resin is the working example 1 and same type) consisting of below composition instead of the paint of the table 1 material, it thed same like the working example 1 and the advertise ash (120  $\times$  150mm) of the No. 1~2 of the table 2 was manufactured.

Paint a (conductive pillar addition)

65% the resin of the working example 1 material.

10% the carbon black of the average particle diameter 25nm as the black additive.

The flake as the conductive pillar (the thickness 1 $\mu$ m, and 25% the Ni of the size 15~20 $\mu$ m)

The integral emissivity of the infrared ray (wavelength 4.5~15.4 $\mu$ m) by the method, mentioning above about each advertise ash obtained in this way the dynamic range of emissivity, and  $\Delta T$  And the electric resistance (conductivity) was measured.

Moreover, as the origin steel board, the black chemical conversion coating was formed on inside and outside side of the Zn-Ni alloy plated steel sheet. By using the painted steel sheet (the No. 3 of the table 2) which once again coated the clear film in the upper part for the surface, it like above statement and the various kinds characteristic was evaluated. In detach and drop board is the formation of the black chemical conversion coating, the plating is electrolyzed and it gets.

And it about the disk of the dance hall which did not enforce paint for comparison to the likeness and the various kinds characteristic was evaluated (the No. 4 of the table 2).

These results was stated in the table 2. Moreover, in the No. 1 of the table 2 in the drawing 13~16, 2, and 3 and 4, the wavelength of the infrared ray and relation of the infrared ray radiation rate were graphed and it showed.

Table 2.

	Y ( $\mu m$ )	P수치	적외선방사율						$\Delta T1$	도전성 ( $\Omega$ )
			표이면		a x b		A-B			
			100°C	200°C	100°C	200°C	100°C	200°C		
	5	31.5	0.70	0.71	0.49	0.50	0.27	0.28	3.5	1~3
	8	52.5	0.83	0.84	0.69	0.71	0.14	0.16	3.7	1~3
	1.5	—	0.57	0.58	0.32	0.34	0.48	0.50	0.5	100~10 <sup>4</sup>
	—	—	0.04	0.05	0.0016	0.0025	0.01	0.01	0	0.01~0.1

금강판 원판 B = Zn-Ni 합금도금강판을 흑색화처리한 것  
 량(실량%)

The coating (No. 1~2) satisfying the requisite of the present invention with the table 2 and drawing is the infrared ray radiation rate, and the dynamic range and  $\Delta$  of emissivity. The requisite of the present invention is satisfied altogether of 1. And the protection against heat characteristic excellents.

Thus, it compares. 3 No the example using conventional black steel sheet (the thing which does not use the black additive including the carbon black etc. and processes with black color). However, the black additive is not used and moreover, the conductive pillar contain does not. Therefore the protection against heat characteristic as much as frame and conductivity cannot be obtained.

Moreover, as to of the infrared ray radiation rate of the disk (No. 4), having no coating the protection against heat characteristic at all could not look at as 0.0016.

Working example 3: the heat dissipation at the first / third coating, the conductivity, and the evaluation of my crack nature and anti-finger printing.

In the present preferred embodiment, it did an experiment in order to confirm the enhancement activity of the conductivity by the enhancement activity of the anti-finger printing by the clear encapsulation and my crack nature and conductive pillar addition.

Specifically, the paint (the polyester resin is used as the base resin. The melamine resin is used as the cross-linking agent) adding flake Ni (the thickness  $1\mu\text{m}$ , and the width  $15\sim 20\mu\text{m}$ ) of the carbon black [the content (X), altogether, 10%] and 0~40% having the various average particle diameter in which the electrolytic galvanized iron (board thickness 0.6mm) is to disk, and shown for the inside and outside side as the undercoat pigment for the table 3 was spread to the same amount each advertise ash ( $120 \times 150\text{mm}$ ) of the No. 1~11 of the table 3 was manufactured stoving (clear film none).

And after paint was spread in order to confirm the enhancement activity of my crack according to the formation of the clear film and anti-finger printing, the poly ester resin of clear was spread and by thereafter drying with stoving each advertise ash ( $120 \times 150\text{mm}$ ) of the No. 12~22 of the table 3 was manufactured (it has the clear film). The double, and the No. 12~14 the example which did not add the conductive pillar Ni.

As to each advertise ash obtained in this way, the heat dissipation and conductivity were evaluated as the working example 1 and similar method. Along with this the anti-finger printing and my crack nature were evaluated as below corner cut. Moreover, the conductivity made on a curve to the standards of less than.

◎: less than the resistance  $10\Omega$  it excellents.



○: superiority resistance  $10\sim 100\Omega$ .

×: fault resistance  $100\Omega$  excess.

[My crack nature]

The diameter  $110\text{mm}$ , and the cylindricity type press machine of the punch diameter about  $50\text{mm}$  were used. The press test was enforced to each advertise ash and the scratch situation of the sliding portion was observed by the naked eye. It evaluated as the standards of less than. Moreover, the punch diameter adjusted so that the Cree lance of the mold become with the  $+40\mu\text{m}$  a and the press condition to the speed  $40\text{spm}$ , and the punch  $R0.5\text{mm}$ .

◎:superiority(changes in appearance none)



: little, it has trace

×: trace clears.

[Anti-finger printing]

The finger was touched to the surface of each advertise ash 1 the first publication and the trace of fingerprint was evaluated as the eye. The evaluation standard thes same like less than.

⊙: the trace of fingerprint cannot be admitted.



: little, it has the trace of fingerprint

×: the trace of fingerprint clears.

The result getting is juxtaposed in the table 3. Moreover, in the table 「-」, the conductive pillar is not added and the clear film is not formed. Therefore it implies not to evaluate each property.

Table 3.

시험치	방사율			냉열성		도전성			크리어 피막 ( $\mu m$ )	내지문성 의 평가	내후성 의 평가
	표온면	$a \times b$		$\Delta T1$ ( $^{\circ}C$ )	상대 평가	Ni량 (%)	도전율 ( $\Omega$ ) A면/B면	상대 평가			
		100 $^{\circ}C$	200 $^{\circ}C$								
	0.79	0.80	0.62	0.64	3.7	0	—	$10^6$ 이상	X	—	—
	0.78	0.80	0.62	0.64	3.7	0	—	$10^6$ 이상	X	—	—
	0.80	0.81	0.64	0.66	3.5	0	20	1~10	0	—	—
	0.78	0.80	0.61	0.64	3.5	0	30	1~10	0	—	—
	0.77	0.79	0.59	0.62	3.5	0	40	1~10	0	—	—
	0.79	0.81	0.62	0.66	3.6	0	20	1~10	0	—	—
	0.79	0.80	0.62	0.64	3.5	0	30	1~10	0	—	—
	0.79	0.80	0.62	0.64	3.5	0	40	1~10	0	—	—
	0.82	0.84	0.67	0.71	3.7	0	30	1~10	0	—	—
	0.83	0.85	0.69	0.72	3.8	0	30	$10 \sim 100$	0	—	—
	0.85	0.87	0.72	0.76	3.9	0	30	$10^6$ 이상	X	—	—
	0.79	0.81	0.62	0.66	3.5	0	—	$10^6$ 이상	X	1.0	0
	0.80	0.82	0.64	0.67	3.5	0	—	$10^6$ 이상	X	5.0	0
	0.79	0.82	0.62	0.67	3.5	0	—	$10^6$ 이상	X	8.0	0
	0.80	0.82	0.64	0.67	3.5	0	30	1~10	0	0.3	0
	0.80	0.82	0.64	0.67	3.6	0	30	1~10	0	1.0	0
	0.80	0.82	0.64	0.67	3.6	0	30	1~10	0	1.5	0
	0.79	0.82	0.62	0.67	3.6	0	30	$10 \sim 100$	0	2.0	0
	0.81	0.83	0.66	0.69	3.6	0	30	$10^5$ 이상	X	5.0	0
	0.80	0.82	0.64	0.67	3.5	0	30	1~10	0	0.05	X
	0.78	0.80	0.61	0.64	3.5	0	10	$10^6$ 이상	X	0.3	0
	0.77	0.79	0.59	0.62	3.5	0	60	1~3	0	0.3	0

주 : X = 카본블랙의 첨가량(전량%)

Y = 도막두께( $\mu m$ )

P 수치 =  $(X-3) \times (Y-0.5)$

It can consider from the table 3 like this.

Firstly, the No. 1~2 does not add the conductive pillar (Ni). The example diversifying the average particle diameter of the black additive (carbon black). However, this average particle diameter is controlled to the desirable range (5~100nm) of the present invention. Therefore, the good protection against heat characteristic altogether gets.

Moreover, the example containing the No. 3~11 is the carbon black among film and ni. However, the double, and the No. 3~10 satisfy the requisite of the present invention. Therefore, it excellents the protection against heat characteristic and the conductivity both. And because the electric resistance of film due to this grew larger because the coating film thickness increased, it can think that the conductivity of the No. 10 a little bit falls in comparision with the other example (No. 3~9).

Because 11 escaped the high limit (less than 12 $\mu$ m) in which the coating film thickness of the black film desirabled No, the conductivity fell in comparision with this.

Moreover, the No. 12~22 shows an example in which the clear film is coated in the black film.

In the double, the No. 12~18, and 21~22, the coating film thickness of the clear film excellent the desirable range of the present invention both the anti-finger printing it satisfies and my crack. However, the No. 12~14 contain does not the conductive pillar. Therefore in 21, the amount of addition of the conductive pillar or does not amount the desirable limit inferior of the present invention No. Therefore the conductivity falls in comparision with the No. 15~21 containing the conductive pillar and 23. Moreover, as to 22, the conductivity in which the amount of addition of the conductive pillar manies is very good No. However, it confirms that workability falls (in the table, it is not described).

In 19, the coating film thickness of the clear film is over the desirable high limit of the present invention in comparision with this No. Therefore the conductivity is interrupted. And the anti-finger printing and my crack nature fell because in 20, the coating film thickness of the clear film escaped the desirable limit inferior of the present invention No.

Working example 4: the evaluation of the heat dissipation at the first / third coating and conductivity.

It the protection against heat characteristic in each test piece which variously diversified the kind of disk and additive in the working example 1, and the emissivity of inside and outside side and conductivity like the working example 1 and this working example measured.

Specifically, the test piece (No. 1~30) consisting of the composition of the table 4 and table 5 material was used. 19 used the double, and the No of the table 5 to process blackening the Zn-Ni alloy plated steel sheet as disk and 26 used the Al board (1050) the No of : table 5 as disk and 27 used the Cu board the No of : table 5 as disk and the test piece of : the outside used the electrolytic galvanized iron as disk. Moreover, the board thickness of disk altogether 0.6mm.

And the base resin used the polyester resin like the working example 1. The melamine resin was used as the cross-linking agent. Each advertise ash (120 ×150mm) of the table 4 and 5 was manufactured with the method like the working example 1 stoving by drying.

The result getting is juxtaposed in the table 4 and table 5.

Table 4.

번		이면										a × b	방원성 ΔT1 (°C)
		P수치	Ni %	도전성 Ω	방사율 b	첨가제		Y μm	P수치	Ni %	도전성 Ω		
						종류	양%						
	m	192.5	—	10 <sup>6</sup> 이상	0.86	*1	14	18	193	—	10 <sup>3</sup> 이상	0.74	4.1
		52.5	30	1~10	0.84	*1	14	12	127	—	10 <sup>5</sup> 이상	0.67	4.0
		46	—	10 <sup>6</sup> 이상	0.80	*1	10	8	52.5	—	10 <sup>6</sup> 이상	0.65	3.8
		18	30	1~10	0.87	*1	14	20	215	—	10 <sup>6</sup> 이상	0.64	3.7
		122.5	—	10 <sup>6</sup> 이상	0.75	*1	5	8	15	—	10 <sup>6</sup> 이상	0.65	3.7
		214.5	—	10 <sup>6</sup> 이상	0.65	*1	10	3	17.5	30	1~10	0.57	3.4
		16.5	30	1~10	0.80	*1	10	8	52.5	30	1~10	0.56	3.3
		52.5	—	10 <sup>6</sup> 이상	0.65	*1	10	3	17.5	—	10 <sup>6</sup> 이상	0.52	3.3
		23	—	10 <sup>6</sup> 이상	0.70	*1	14	2	16.5	—	10 <sup>6</sup> 이상	0.55	3.1
		11	30	1~10	0.83	*1	10	12	80.5	—	10 <sup>6</sup> 이상	0.49	3.0
		13.5	—	10 <sup>6</sup> 이상	0.65	*1	10	3	17.5	—	10 <sup>6</sup> 이상	0.46	3.0
		10.5	—	10 <sup>6</sup> 이상	0.86	*1	14	18	193	—	10 <sup>6</sup> 이상	0.47	2.8
		16.5	30	1~10	0.85	*1	10	3	17.5	30	1~10	0.46	2.8
		192.5	—	10 <sup>6</sup> 이상	0.52	*1	14	1.1	6.6	—	10 <sup>6</sup> 이상	0.45	2.7
		13.5	—	10 <sup>6</sup> 이상	0.62	*1	10	2.5	14	—	10 <sup>6</sup> 이상	0.43	2.6

(조블렉)

첨가량)-3]×[Y(도막두께)-0.5]

Table 5.



이면													방열성 ΔT1 (°C)
구분	P수치	Ni %	노전성 Ω	방사율 b	절가제		Y μm	P수치	Ni %	노전성 Ω	a × b		
					종류	양 %							
1		-	10 <sup>2-3</sup>	0.81	*1	7	12	46.0	30	1~10	0.10	1.5	
	52.5	30	1~10	0.10	없음	없음	0.5		-	0.1~1	0.08	1.5	
	16.5	30	1~10	0.04	부도장				-	0.01~0.1	0.03	1.3	
	10.5	-	10 <sup>6</sup> 이상	0.45	부도장				-	0.01~0.1	0.34	1.0	
		-	0.01~0.1	0.70	*1	14	2	16.5	-	10 <sup>6</sup> 이상	0.03	1.3	
		-	10 <sup>2-3</sup>	0.12	없음	없음	1		-	10 <sup>2-3</sup>	0.01	0.5	
		-	0.01~0.1	0.04	부도장				-	0.01~0.1	0.002	0 (표준)	
2		-	10 <sup>6</sup> 이상	0.84	*1	14	12	127	-	10 <sup>6</sup> 이상	0.67	4.0	
3		-	10 <sup>6</sup> 이상	0.80	*1	10	8	52.5	30	1~10	0.65	3.8	
4		-	10 <sup>6</sup> 이상	0.75	*1	5	8	15.0	30	1~10	0.65	3.7	
5		-	10 <sup>6</sup> 이상	0.80	*1	10	8	52.5	30	1~10	0.52	3.4	
6		-	10 <sup>6</sup> 이상	0.86	*1	14	18	193	-	10 <sup>6</sup> 이상	0.74	4.1	
7		-	10 <sup>6</sup> 이상	0.86	*1	14	18	193	-	10 <sup>6</sup> 이상	0.74	4.1	
8		-	10 <sup>6</sup> 이상	0.04	부도장				-	0.01~0.1	0.03	1.4	
9		-	10 <sup>6</sup> 이상	0.10	없음	없음	0.5		-	0.1~1	0.08	1.5	

본블랙, \* 2 : 산화티탄, \* 3 : 신화철, \* 4 : Al 플레이트  
크릴비즈)

첨가량)-3]×[Y(도파누제)-0.5]

Zn-Ni 합금도금강판을 흑색화처리한 것 ;

Al 판, No. 27 은 Cu 판을 사용

It is seen that in the table 4 and table 5, coating (the No. 1~15 of the table 4, and the No. 23~28 of the table 5) satisfying the requisite of the present invention altogether have the good protection against heat characteristic. As (A × b among table) of emissivity bigs, the protection against heat characteristic excellents. Moreover, as to coating (the No. 16~18 of the No. 2, 4, 6~7, 10, 13 : table 5 of the table 4, and 24~26), adding Ni among film the conductivity moreover excellent.

The double, and the No. 23~26 of the table 5 add the carbon black in the rear side. The example (the example which as to as to as to as to as to 23, 24, 25, 26, only the Al flake adds No the example : No which only the titanium oxide adds the example : No mixing and adds the titanium oxide and ferric oxide the example : No mixing and adds the carbon black and acrylics) in which additive except the carbon black is added and constituting the exoergic film in the surface. However, since satisfying the requisite of the present invention, the excellent protection against heat characteristic is displayed.

Thus, it compares. In coating (the No. 16~22 of the table 5, and 29~30) which does not satisfy the requisite of the present invention, the protection against heat characteristic are altogether behind. Particularly, the No. 18~20 of the table 5, and 29 the example which only one side coats with paint. However, the protection against heat characteristic as much as frame cannot obtain.

Hereinafter, the working example 5 evaluates the various kinds characteristic about the coating of the second / third around the heat dissipation and magnetic cooling nature related to the invention.

Working example 5: the evaluation of the heat dissipation at the second / third coating and conductivity.


In the present preferred embodiment, in the working example 1, the magnetic cooling nature was evaluated with the method which mentioned above with the protection against heat characteristic at each test piece diversifying the kind of additive, and the emissivity of inside and outside side and conductivity being like the working example 1 and measuring.


Specifically, the test piece (No. 1~19) consisting of the composition in table 6 was used. 17 used the double, and No (disk 0.6mm) to process blackening the Zn-Ni alloy plated steel sheet as disk. The except used the electrolytic galvanized iron (disk 0.6mm) as disk. As to the base resin, all test pieces uses the polyester resin like the working example 1. The melamine resin is used as the cross-linking agent and by drying each advertise ash (120 × 150mm) is manufactured with the method like the working example 1 stoving.

Moreover, it shows the protection against heat characteristic  $\Delta T_1$  made on a curve to below standards. In the second coating related to the invention, coating is evaluated as 「the good heat dissipation is displayed as to

coating」 . 

◎ :  $3.5 \leq \Delta T_1$

 :  $2.7 \leq \Delta T_1 < 3.5$

 :  $1.5 \leq \Delta T_1 < 2.7$

△ :  $1.0 \leq \Delta T_1 < 1.5$

× :  $\Delta T1 < 1.0$

Moreover, it shows the magnetic cooling nature  $\Delta T2$  made on a curve to below standards.  $\Delta T$ The thing with a superior protection against heat characteristic it bigs if 2 bigs is shown. Moreover, in the second coating related

to the invention, coating is evaluated as 「the excellent magnetic cooling nature is displayed」 .

◎ :  $1.5 \leq \Delta T2$

○ :  $1.5 \leq \Delta T2 < 1.5$

× :  $\Delta T2 < 0.5$

The result getting was stated with the table 6 in 7.

Table 6.



Table 7.

No.	방사율		Q수치 $0.9a-b$	R수치 $(a-0.05) \times (b-0.05)$
	표면 $a$	이면 $b$		
1	0.86	0.23	0.54	0.15
2	0.87	0.35	0.43	0.25
3	0.68	0.27	0.34	0.14
4	0.70	0.38	0.25	0.21
5	0.86	0.52	0.25	0.38
6	0.79	0.48	0.23	0.32
7	0.62	0.35	0.21	0.17
8	0.84	0.55	0.21	0.40
9	0.86	0.65	0.12	0.49
10	0.65	0.50	0.09	0.27
11	0.48	0.36	0.07	0.13
12	0.80	0.65	0.07	0.45
13	0.68	0.04	0.57	-0.01
14	0.40	0.24	0.12	0.07
15	0.12	0.12	-0.01	0.005
16	0.83	0.81	-0.06	0.59
17	0.43	0.45	-0.06	0.15
18	0.73	0.81	-0.15	0.52
19	0.04	0.04	-0.004	0.000

In the table, while the coating (No. 1~12) satisfying the requisite of the present invention altogether keeps the good protection against heat characteristic, the excellent magnetic cooling nature is had moreover. Particularly, it is seen that in the index of the magnetic cooling nature equation (4), the No. 1~8 in which Q value (=  $0.9a - b$ ) is more over 0.045 or greater displays the very excellent magnetic cooling nature. And the magnetic cooling nature excellents as Q value bigs.

Moreover, coating (No. 1~5, 7~9, 11~12) adding Ni among film moreover excellent the conductivity.

The carbon black contain degree film is coated in the double, and the No. 3 of the table 6 and 7 silver surface. 12 coats the carbon black contain degree film the example : No. 6 / No which only film coats in the rear side in the surface / rear side. 10 coats the Al flake contain degree film the example : No coating the titanium oxide contain degree film in the rear side / surface in the example : No. 11 silver surface which altogether coats the metallic color external view film in inside and outside side. The example coating the carbon black contain degree film in the rear side (joining the none). However, while having the excellent magnetic cooling nature since altogether satisfying the requisite of the present invention, the heat dissipation is good.

Moreover, 11 the No.1 of the table 6 and No the example adding the carbon black in the film of the rear side. However, even if the equation (6) is not satisfied, index [the equation (4) and (5)] decided in the second coating body are satisfied. Therefore as to the magnetic cooling nature, the protection against heat characteristic is good.

Thus, it compares. In the coating (No. 13~19) which does not satisfy the requisite of the present invention, the magnetic cooling nature is altogether behind.

For example, as to 13, the protection against heat characteristic based to one side coating does not enforce coating to one side cannot obtain No. Similarly, in 14, the composition of the surface (carbon black contain degree film) does not satisfy the equation (6) No. Therefore the indexed equation (5) of the protection against heat characteristic is not satisfied. The protection against heat characteristic as much as frame cannot obtain. No. Joining does not cannot be added at all in figure 15 inside and outside side and because the coating film thickness thins, the protection against heat characteristic as much as frame cannot obtain.

In the meantime, 16 for example cannot obtain the magnetic cooling nature as much as frame No of the extent that the emissivity of inside and outside side similars. No. Because the extent that the emissivity of inside and outside side similars becomes to the hitherto example processing blackening inside and outside side to the method for thing same, 17 cannot obtain the magnetic cooling nature as much as frame. No. The magnetic cooling nature in which the emissivity of the rear side bigs in comparison with 18 silver surface falls.

Below working example 6 examines about the chromium-free coating around the corrosion resistance, the coating adhesiveness, and workability and conductivity related to the invention.

Working example 6: the corrosion resistance at the chromium-free coating, the coating adhesiveness, and the evaluation of the conductivity and workability.

In the present preferred embodiment, the paint of the same amount was spread in inside and outside side of the substrate in which the primer treatment of chromium-free was enforced. Coating was used. Enforced the exoergicity film of the isopachous the different property of mentioning above was evaluated.

Specifically, electrolytic galvanized iron (the board thickness 0.8mm, and one side Zn bond quantity  $20\text{g} / \text{m}^2$ ) were used as disk. It underlay of chromium-free by the Japanese paint corporation the 「the sharp coating EC 2000 (si bond quantity  $50\text{mg} / \text{m}^2$ )」. After flake Ni (the thickness  $1\mu\text{m}$ , and the width  $15\sim 20\mu\text{m}$ ) were spread according to the use 「 and need to the same amount to mix the paint component 「 base resin in the carbon black (10%) as the undercoat pigment in the inside and outside side and table 8, and the cross-linking agent,

the rust preventive (aluminium tripolyphosphate and calcium ion exchange silica to the mass rate of 8 : 2 and the exoergicity film was formed, after drying each advertise ash (120×150mm) of the No. 23 of the table 8 was manufactured stoving, paint was spread at the same time with (clear film none), the poly ester resin of clear was spread and by thereafter drying with stoving each advertise ash (120×150mm) of the No. 1~22 of the table 8 was manufactured (it has the clear film). Here, the coating film thickness of the exoergicity film altogether 8 $\mu$ m. And the coating film thickness of the clear film altogether 1 $\mu$ m. Moreover, the No. 21 shows an example in which the conductive pillar Ni is not added.

The anti-finger printing and my crack nature were evaluated as the method like the working example 3 with evaluating the heat dissipation and conductivity about each advertise ash obtained in this way as the method like the working example 1. It evaluated about the corrosion resistance, and the coating adhesiveness and workability as the standards of less than.

#### [Corrosion resistance]

By using each test piece, the salt spray test ruled in JIS-Z-2371 is enforced 72 hours or 120 hours. The area rate of the outer tube phase shift unit (it has a fine nap the rust ·) generating in the film of the planar section is measured in each elapsed time. In this way, the area rate of the outer tube phase shift unit measured at says to be the thing 「invention example」 less than 10%.

#### [The workability (the number of cracks)]

The number of this crack the test piece is cut to 50 ×50mm is and the crack of the bent portion is observed to the videoscope photographs (the magnification is 25 times) is measured. Specifically, the long number of crack existing among 3mm width viewing direction more than the diameter 0.1mm is measured and the mean of the number of crack at the total 10 viewing direction is evaluated as 「number of crack」. In this way, it evaluates as the thing 「invention example」 in which 「number of crack」 measured at is 5 less than.

#### [Workability (coating adhesiveness)]

After the intimate bending test is performed, the bent portion is tempered. The coating adhesiveness is evaluated according to the extent of the paint film exfoliation after exfoliating tape as below standards. The estimated-targets part to 40mm detonating composition except for both ends 5mm of sample.



: exfoliation none.

△:little, it has exfoliation(the exfoliation of film is 3 within in the evaluating part)

×:it has exfoliation(over the exfoliation of film is 4 in the evaluating part)

The result getting was juxtaposed in the table 8.

Table 8.



박(방일도막)				상충도막 (-리이도막)		특성			
가교제	비율	방청제	NI	노막두께 μm	내식성 72시간/20시간	크랙수	기공성	밀착성	도전성 Ω
*15(%)									
5.8	0.24	—	25	1	20	40	0	○	1~10
5.6	0.25	2	25	1	3	6	0	○	1~10
5.3	0.25	5	25	1	1미만	1미만	0	○	1~10
5.0	0.24	8	25	1	1미만	1미만	2	○	1~10
4.2	0.24	18	25	1	1미만	1미만	4	○	1~10
3.4	0.24	27	25	1	1미만	1미만	7	△	1~10
5.3	0.25	5	25	1	1미만	1미만	1	○	1~10
0	—	5	25	1	1미만	1미만	5	○	1~10
5.5	—	5	25	1	6	10	0	○	1~10
5.4	0.11	5	25	1	4	7	0	○	1~10
5.5	0.18	5	25	1	1미만	2	0	○	1~10
5.3	0.25	5	25	1	1미만	1미만	0	○	1~10
5.3	0.38	5	25	1	1미만	1미만	1	○	1~10
5.2	0.58	5	25	1	1미만	1미만	4	○	1~10
5.0	1.00	5	25	1	1미만	1미만	9	○	1~10
9.8	0.12	5	25	1	1미만	1미만	1	○	1~10
2.8	0.43	5	25	1	1미만	3	1	○	1~10
1.8	2.94	5	25	1	1미만	1미만	10	○	1~10
1.2	8.17	5	25	1	1미만	1미만	15	△	1~10
5.3	0.25	5	25	1	12	20	0	×	1~10

It can consider with the table like this. Moreover, each test piece described in the above can confirm to have the anti-finger printing and excellent my crack nature about the No. 1~22 enforcing the clear film while altogether having the good protection against heat characteristic (in the table, it does not state).

Firstly, in coating (No. 2~5, 7~14, 16~17, 21~23) satisfying the requisite of the present invention, the corrosion resistance, and the coating adhesiveness and workability altogether excellent. Particularly, the coating weight melamine based crosslinking agent and coating can know in comparison with coating (No. 8, 9) which it independently uses jointly the isocyanate system cross-linker to the determined ratio that the property markedly excellents. Moreover, the coating (coating takes out 23 No) enforcing the clear film on the heat dissipation film gets ready the very excellent corrosion resistance. And 8 No the example enforcing moreover, the clear film as the cross-linking agent with the single use (amount of addition 5.5 mass %). However, it confirms with experiment to have the very excellent corrosion resistance [the area rate of the outer tube phase shift unit at the salt spray test corrosion test (120 hours) is less than 1%] of the extent of thing same even if the clear film is not enforced (it does not appear in the table).

And as to the coating (coating except for the No. 21), adding the conductive pillar Ni the peel nature is good.

On the contrary, coating (No. 1, 6, 15, 18~ 20) which does not satisfy the requisite of the present invention have the irrationality of less than.

Firstly, 1 No the example which does not use the rust preventive. And the corrosion resistance falls.

No. 6 the example in which amount of resin littles. And the coating adhesiveness and workability fall.

No. For in 15, 18 and 19, the containing rate of the melamine based crosslinking agent, many examples the number of these, altogether, crackses many about the isocyanate system cross-linker (in other words, the containing rate of the isocyanate system cross-linker littles). Workability falls. Particularly, for the containing rate of the melamine based crosslinking agent, many noes. the number of crack 19 enough cannot obtain the workability enhancement activity by the addition of the isocyanate system cross-linkers is very very more and the coating adhesiveness falls.

No. In 20, for example, the corrosion resistance and the coating adhesiveness using the poly ester resin falls.

#### ■ Effects of the Invention

Coating of the present invention provides the coating for the electronic device member which is composed like the or more, and therefore, while required conventional property (the confidentiality secure accompanied with the waterproofing · dustproof lighting fitting, and the miniaturization · light weight) are satisfied with the electronic device member, the property (the magnetic cooling nature) controlling coating : for the new electronic device member, which the decline (protection against heat characteristic) of the inner temperature of this electronic device member can include moreover, the temperature rise of the coating itself for the electronic device member excellents. And the coating of the . the invention can use for especially, the AV machine : copy machine of the electrical & electronics · communications related field etc, the projector, the television, video, the game console etc, printer, including, the copy machine : air conditioner outsider, including, the power box cover, the control box cover, the vending machine, refrigerator etc, all kinds of the electronic device members including the information write field : personal computer of the CD, LD, DVD, CD-ROM, CD-RAM, PDP, LCD etc, the car navigator, the car AV etc.



#### Scope of Claims

Claim 1 :

$(X - 3) \times (Y - 0.5) \geq 15$  ..... the black additive is composed in the base resin consisting of the poly ester resin, polyolefin resin, fluorine-based resin, silicone resin in inside and outside side of substrate and their mixing or the degenerated resin.

(1)

The arbitrary location T when coating uses coating as the advertise ash the exoergicity film which is to configuration is coated. 1Temperature T. 1AThe arbitrary location T when using the substrate in which film is not coated as the advertise ash. 1Temperature T. 1BThe temperature differential  $\Delta$  of NULL. T1(= T1B- T1AThe coating for the electronic device member with a superior heat dissipation wherein it becomes over 2.6°C (電子機器部材用 塗装體)

Claim 2 :

$(X - 3) \times (Y - 0.5) \geq 15$  the black additive is composed in the base resin consisting of the poly ester resin, polyolefin resin, fluorine-based resin, silicone resin in inside and outside side of substrate and their mixing or the degenerated resin.

The integral emissivity of the infrared ray (wavelength 4.5~15.4 $\mu$ m) when coating heated this with 100°C the exoergicity film which was to configuration was coated is the next formula. The coating for the electronic device member with a superior heat dissipation wherein (2) is satisfied

$$a \times b \geq 0.42 \dots\dots\dots(2)$$

However a: the infrared ray integral emissivity of coating the exoergicity film is coated in the surface.

b: the infrared ray integral emissivity of coating the exoergicity film is coated in the rear side.

Claim 3 :

The infrared ray integral emissivity of coating the exoergicity film is coated as to claim 2.

The coating for the electronic device member satisfying  $a \geq 0.65$  and/or the  $b \geq 0.65$ .

Claim 4 :

The coating for the electronic device member in which the difference (A-B) when heating coating with 100°C the exoergicity film is coated as to claim 2 with the maximum value A of the spectral emissivity at the wavelength region of the infrared wavelength 4.5~15.4 $\mu$ m and minimum value B are 0.35 or less.

Claim 5 :

Claim 6 :

The coating for the electronic device member satisfying in the black additive, contained in the exoergicity film the content the next formula as to the first claim or claim 2.

$$4 \leq X < 15 \dots\dots\dots(3)$$

Claim 7 :

The coating for the electronic device member satisfying the thickness (Y) of the exoergicity film is  $Y > 1 \mu\text{m}$  as to the first claim or claim 2.

Claim 8 :

The coating for the as to the black additive, contained as to the first claim or claim 2 in the exoergicity film the average particle diameter 5~100nm electronic device member.

Claim 9 :

The coating for the black additive as to the first claim or claim 2 the carbon black electronic device member.

Claim 10 :

Claim 11 :

The infrared ray radiation rate of coating is the next formula the exoergicity film is coated as to claim 2.

(4) And equation The coating for the electronic device member satisfying (5).

$$b \leq 0.9(a - 0.05) \dots\dots\dots(4)$$

$$(a - 0.05) \times (b - 0.05) \geq 0.08 \dots\dots\dots(5)$$

a: the infrared ray integral emissivity of coating the exoergicity film is coated in the surface.

b: the infrared ray integral emissivity of coating the exoergicity film is coated in the rear side.

Claim 12 :

$(X - 3) \times (Y - 0.5) \geq 3 \dots\dots\dots$  the black additive is composed in the base resin consisting of the poly ester resin, polyolefin resin, fluorine-based resin, silicone resin in inside and outside side of substrate and their mixing or the degenerated resin.

(6)

Here, the arbitrary location T when coating uses coating as the advertise ash the exoergicity film is coated  
 2Temperature T.2AThe arbitrary location T when using the substrate in which film is not coated as the advertise ash.  
 2Temperature T.2BThe difference  $\Delta$  of NULL.  $T_2 (= T_2B - T_2A)$  The coating for the electronic device member with a superior heat dissipation and magnetic cooling nature wherein it becomes over 0.5°C

Claim 13 :

The content (X), of the black additive contained as to claim 12 in the exoergicity film is  $4 \leq X < 15 \dots\dots\dots$ .

The coating for the electronic device member satisfying (7).

Claim 14 :

The coating for the electronic device member satisfying the thickness (Y) of the exoergicity film is  $Y > 1\mu\text{m}$  as to claim 12.

Claim 15 :

The coating for the average particle diameter of the black additive as to claim 12 5~100nm electronic device member.

Claim 16 :

The coating for the black additive as to claim 12 the carbon black electronic device member.

Claim 17 :

The first claim to claim 4. And the coating for the electronic device member of any one of claims 11 through 16, wherein the resin forming the exoergicity film the hydrophobic resin

Claim 18 :

The coating for the hydrophobic resin as to claim 17 the poly ester resin electronic device member.

Claim 19 :

The first claim to claim 4. And the coating for the electronic device member with a superior conductivity of any one of claims 11 through 16, wherein the electric resistance moreover satisfies 100Ω or less

Claim 20 :

The first claim to claim 4. And the coating for the electronic device member of any one of claims 11 through 16, wherein the exoergicity film the conductive pillar is contain

Claim 21 :

The coating for the electronic device member which the conductive pillar (filler) continues as to claim 20 Ni.

Claim 22 :

The first claim to claim 4. And the coating for the electronic device member of any one of claims 11 through 16, wherein the exoergicity film my crack nature and anti-finger printing are here enhanced since the clear film is coated

Claim 23 :

Moreover, the exoergicity film is the rust preventive (防 substrate is processed as to the first claim to claim 4, and any one of claims 11 through 16 the summer solstice of the chromium-free (Cr-free).

鍍The coating for the electronic device member containing 劑).

Claim 24 :

The coating for the moreover, the thickness of this exoergic film  $2\mu\text{m}$  or greater electronic device member in which the exoergic film contain the conductive pillar (filler) as to claim 23

Claim 25 :

The coating for the electronic device member satisfying the crack number in the intimate bending test which coating is ruled in JIS-K-5400 coated in inside and outside side of the substrate which is the chromium-free primer treatment is 5 less than as to claim 23.

Claim 26 :

The coating for the electronic device member satisfying the area rate of the outer tube phase shift unit in the salt spray test corrosion test (72 hours) which coating is ruled in JIS-Z-2371 coated in inside and outside side of the substrate which is the chromium-free primer treatment is 10% or less as to claim 23.

Claim 27 :

The coating for the electronic device member satisfying the area rate of the outer tube phase shift unit in the salt spray test corrosion test (120 hours) which coating is ruled in JIS-Z-2371 the clear film is again coated on the exoergic film is 10% or less as to claim 23.

Claim 28 :

The coating for the electronic device member satisfying coating is the electric resistance  $100\Omega$  or less as to claim 23.

Claim 29 :

Claim 30 :

Claim 31 :

Claim 32 :

Claim 33 :

Claim 34 :

Claim 35 :

Claim 36 :

Claim 37 :

Claim 38 :

Claim 39 :

Claim 40 :

The electronic machinery part, wherein this electronic machinery part the electronic machinery part having within the heating element in the closed space it is composed of the coating for the electronic device member in the exterior wall, whole, in other words, a part is the first claim to 4 claim, and one among the claims 11 through 16 (電子機器部品).

Claim 41 :

Claim 42 :



Drawings

Fig. 1

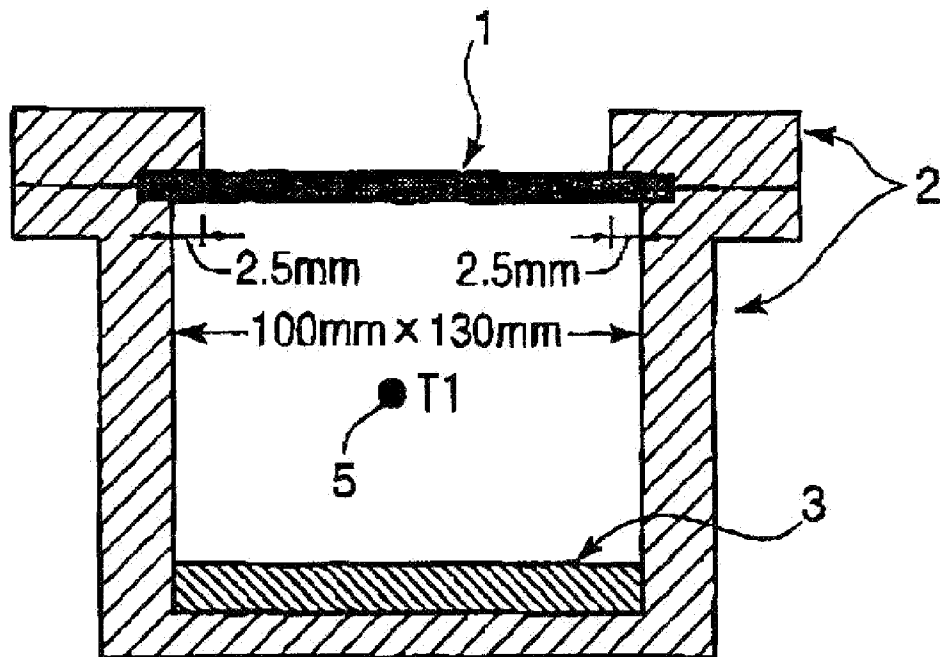


Fig. 2

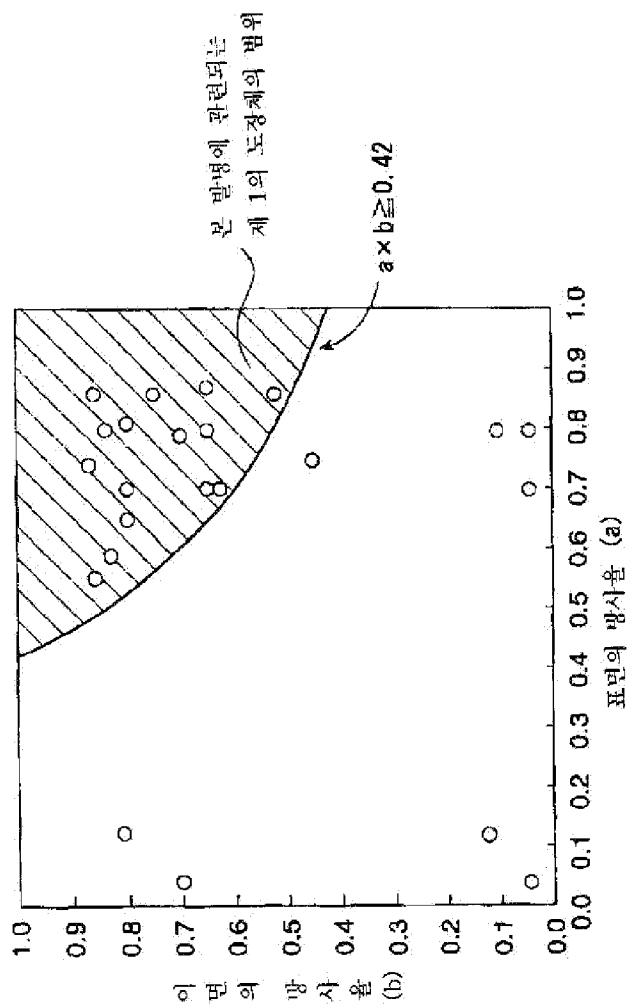


Fig. 3



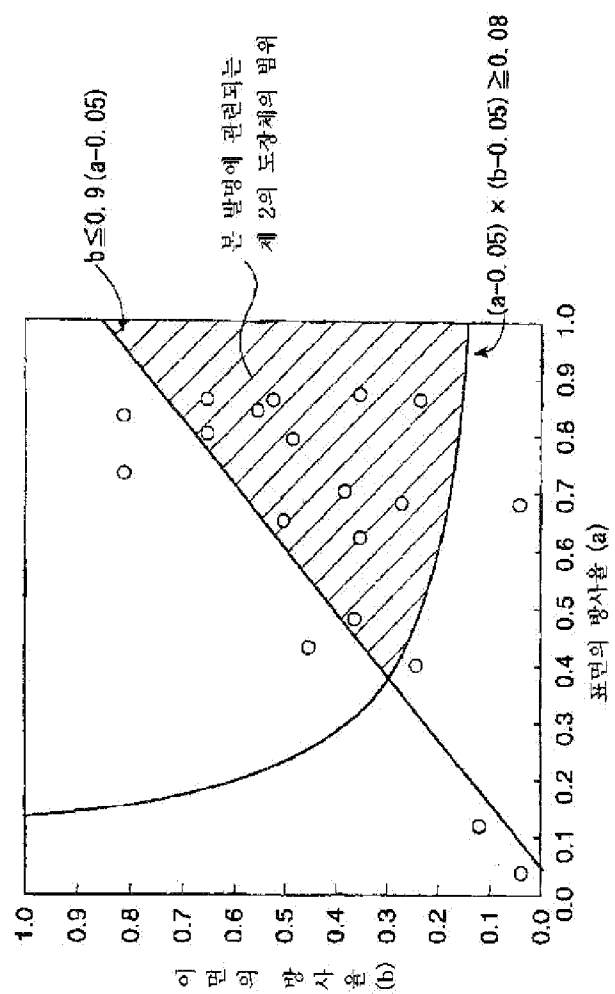


Fig. 4

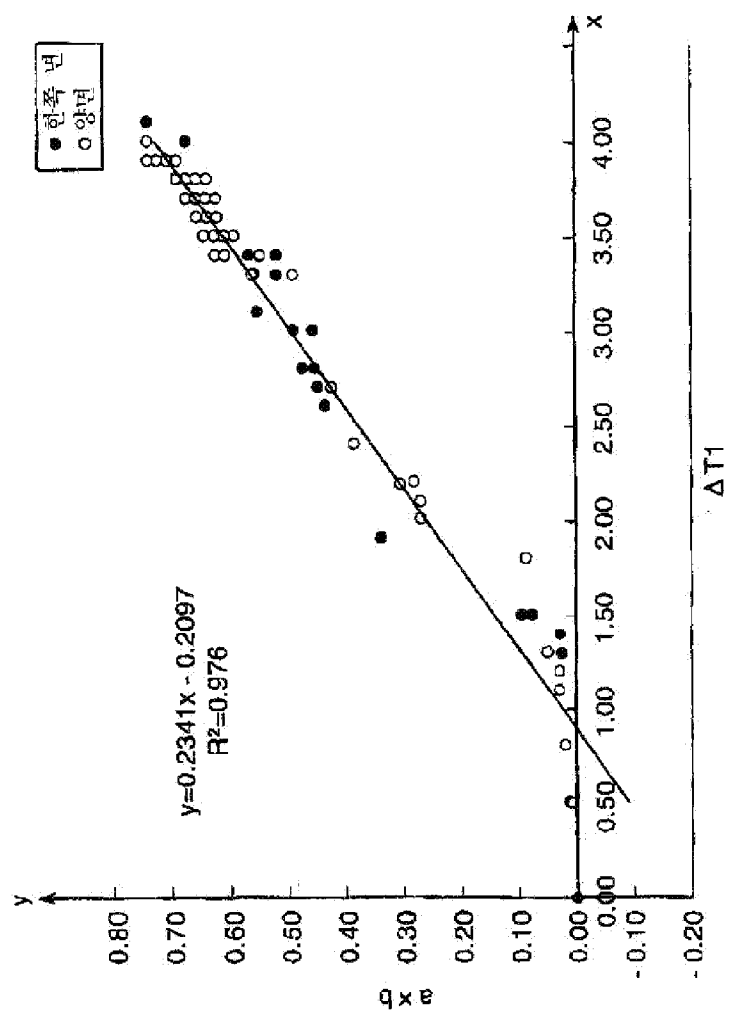


Fig. 5

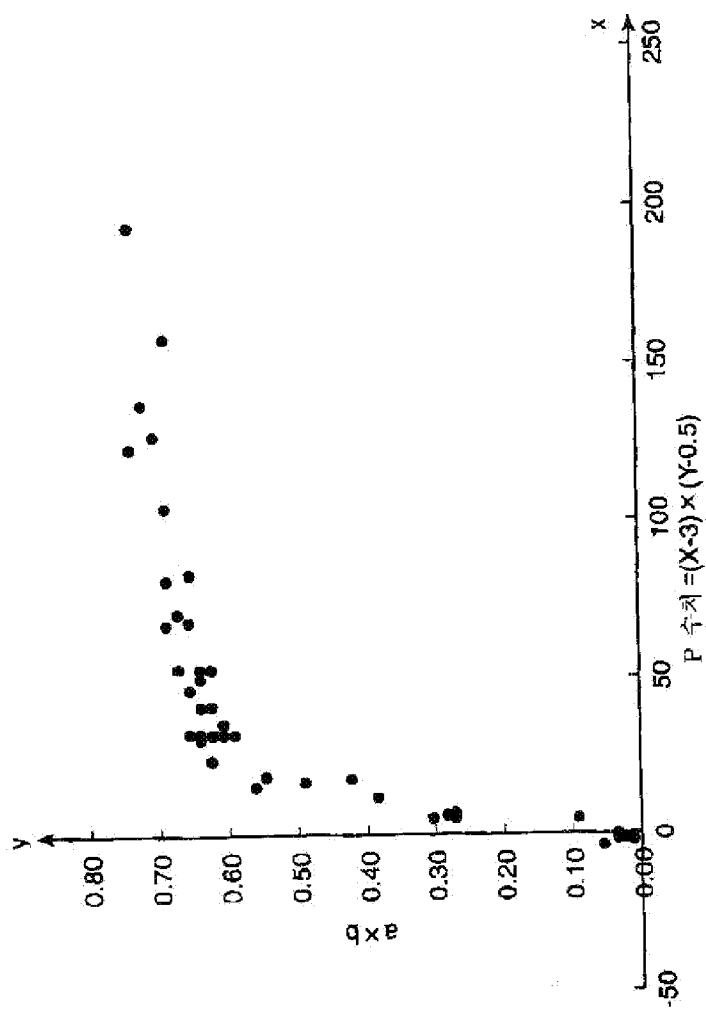


Fig. 6

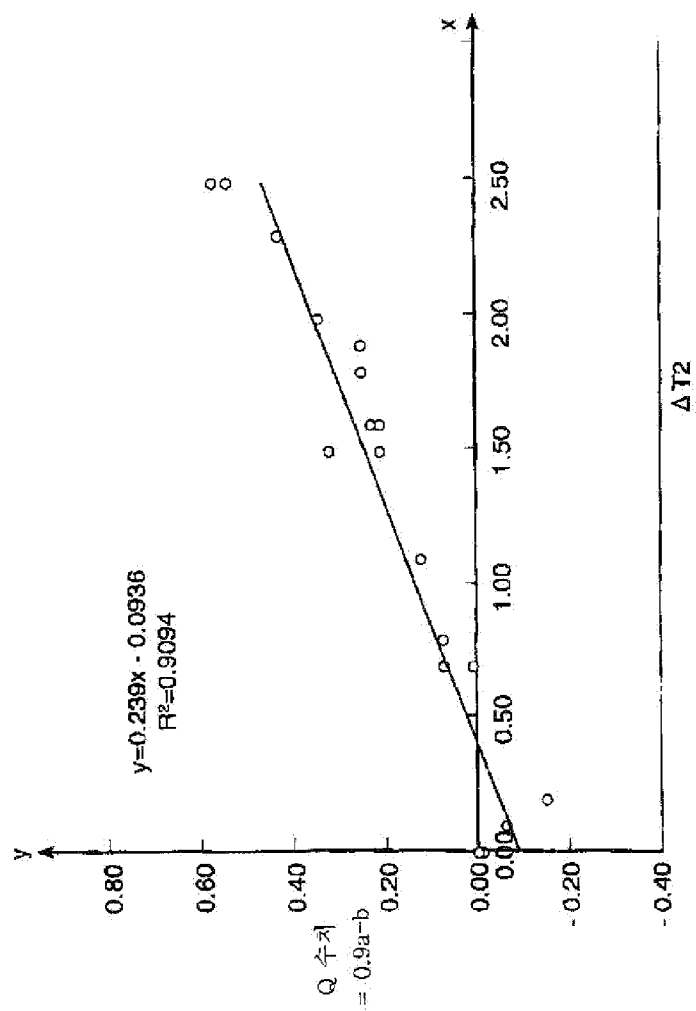


Fig. 7

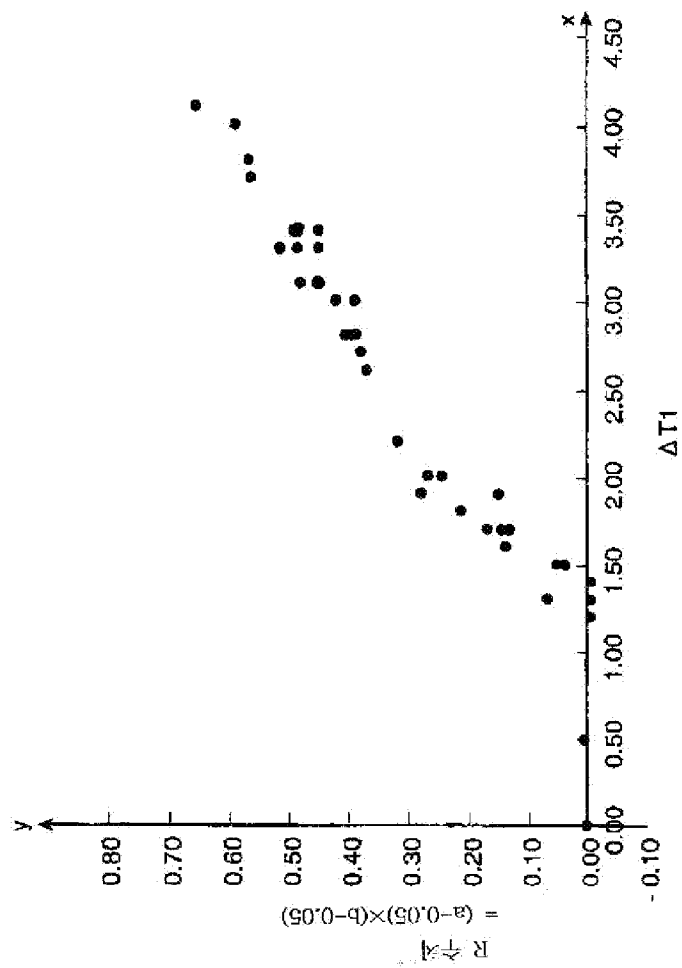


Fig. 8

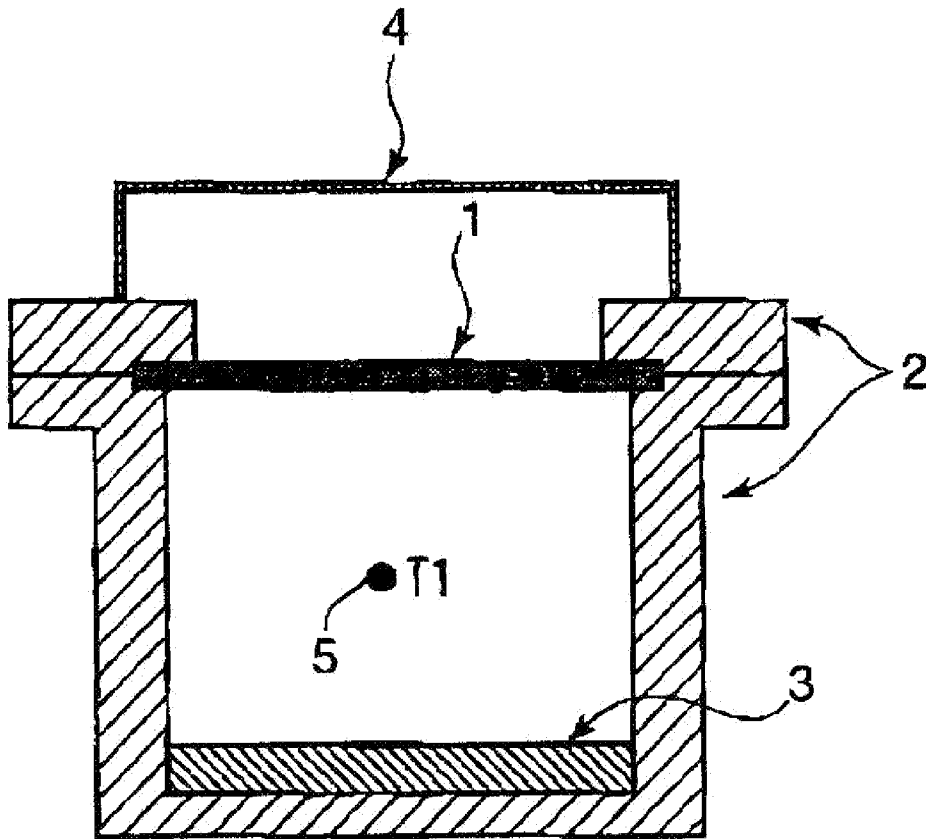


Fig. 9

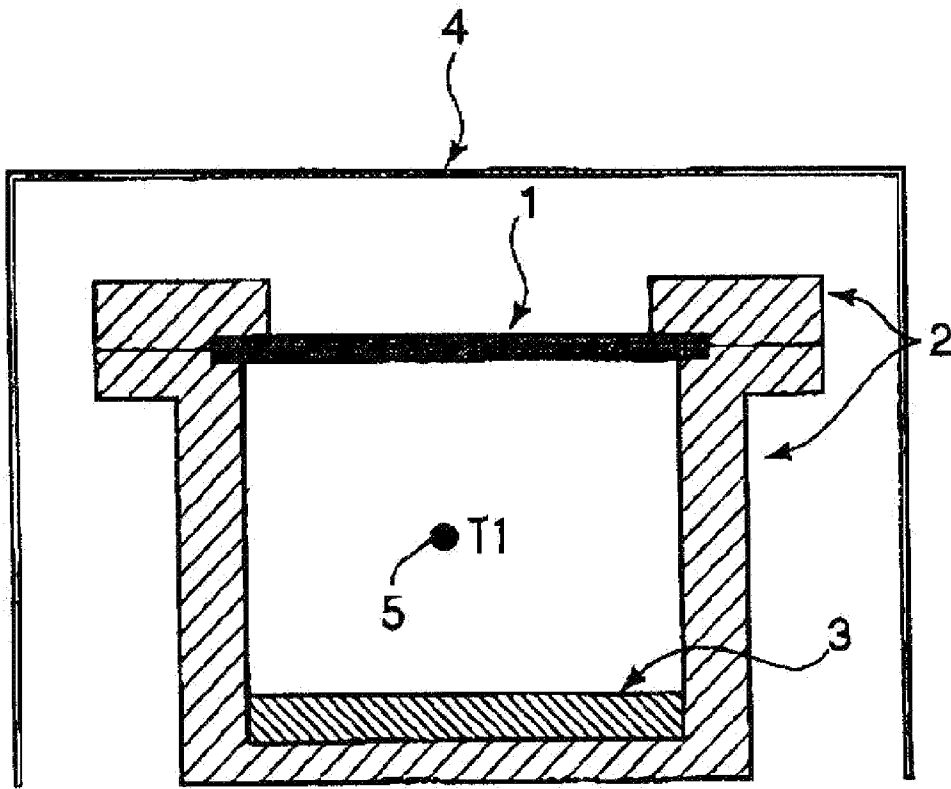


Fig. 10

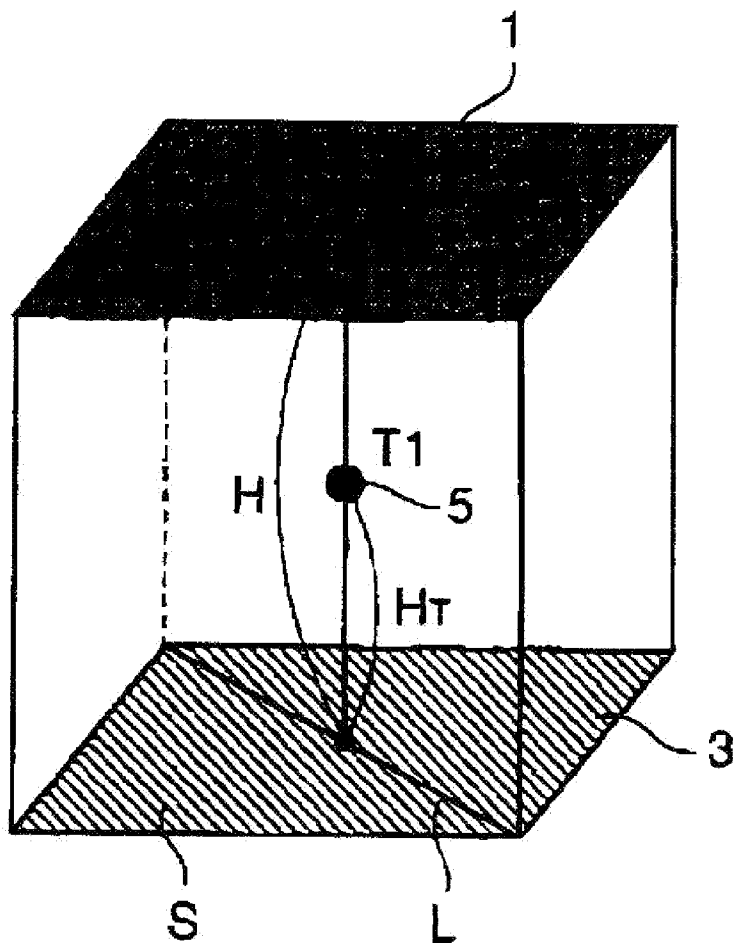


Fig. 11



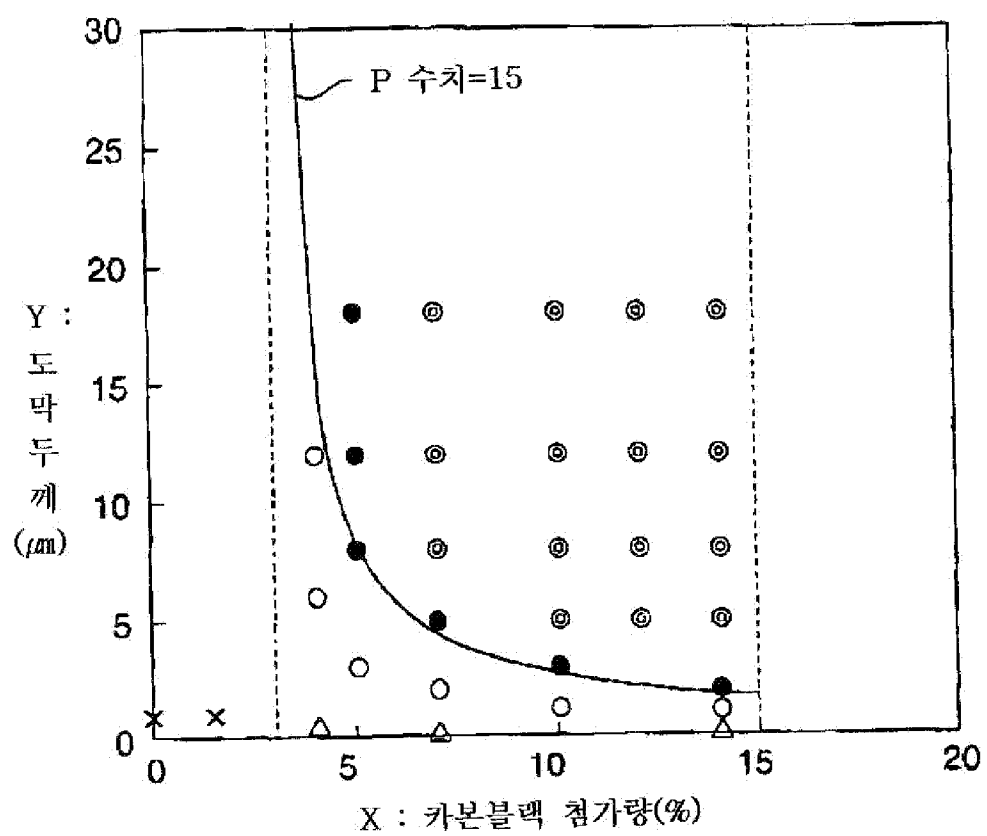


Fig. 12

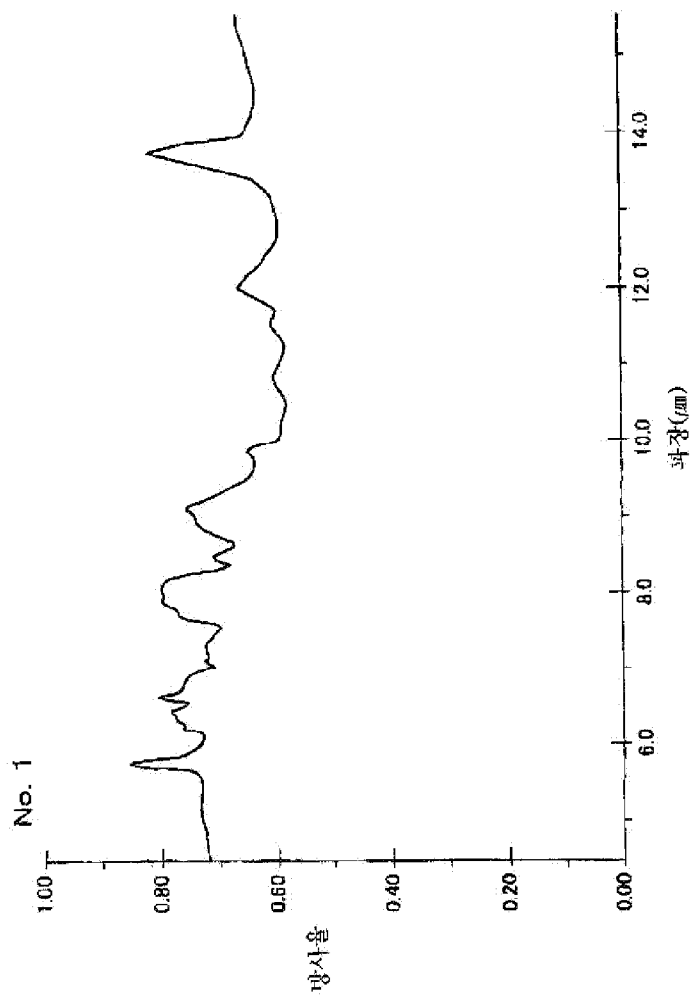


Fig. 13

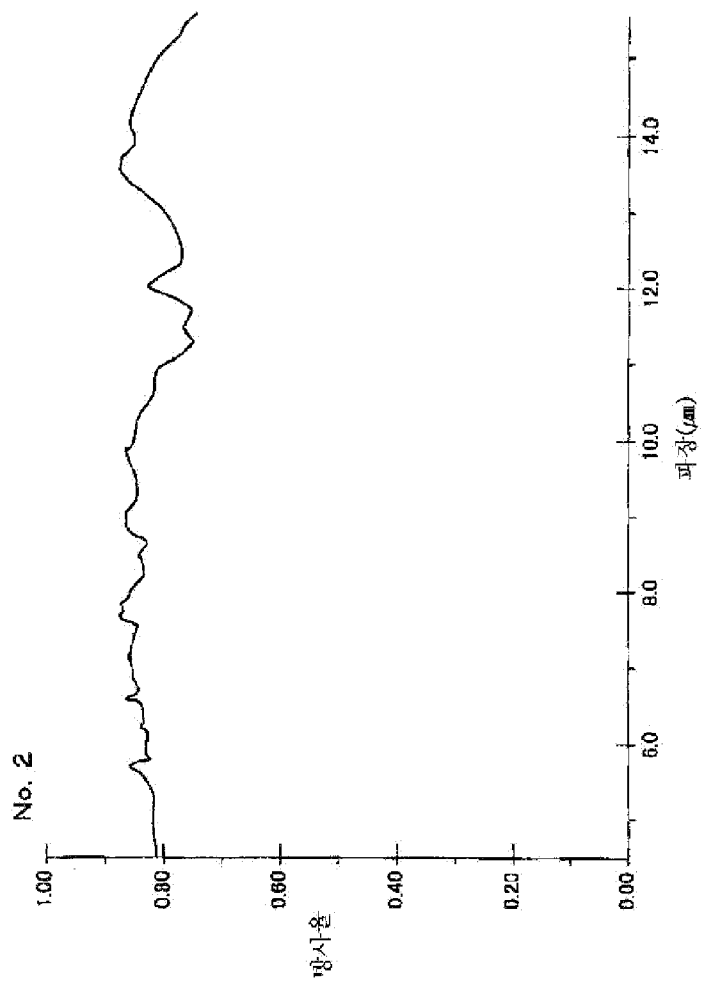


Fig. 14

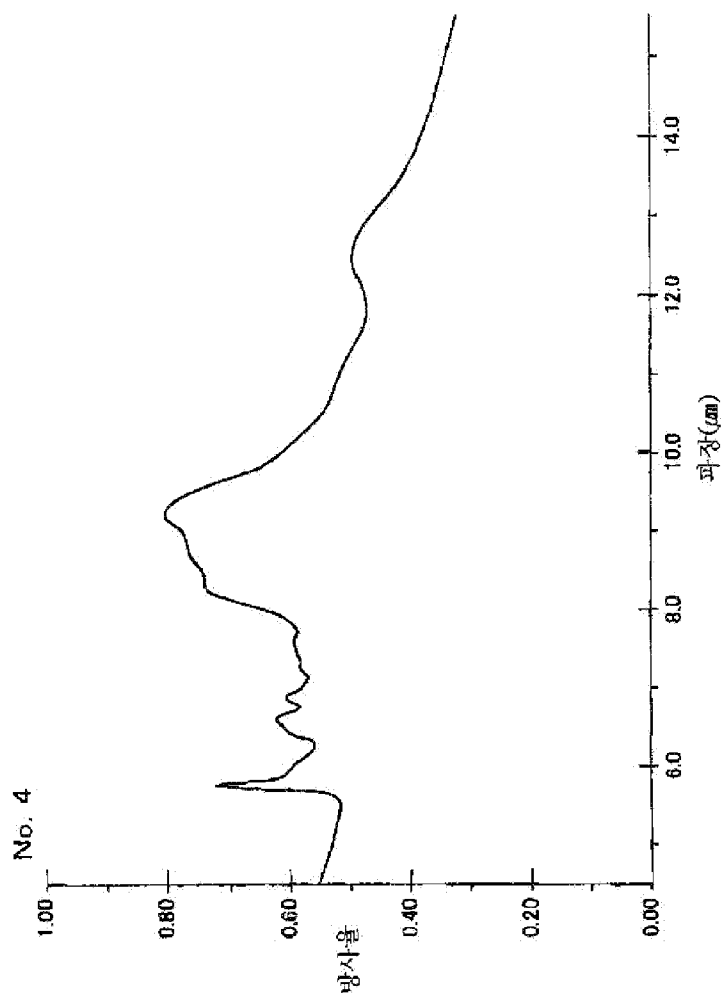


Fig. 15

